Vol. XI. September, 1896. No. 3.

343006
AUG 31 1896

PAVING SEWERAGE MUNICIPAL ENGINEERING WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS NEW YORK

Two Dollars Per Year. Single Copies, 25 Cents.

ASPHALT PAVEMENTS

THE BARBER ASPHALT PAVING COMPANY

NO. 1 BROADWAY, NEW YORK

•• ESTABLISHED ••
1878

•• INCORPORATED ••
1883

HIGHEST AWARDS
WORLD'S
EXPOSITION

RECEIVED AT
COLUMBIAN
CHICAGO, 1893

1st. ***Asphalt and Asphaltic Cements:*** The Refined Asphalt and Asphaltic Cements for Pavements and Asphaltic Mastics are of excellent quality and up to the required standard. They are therefore worthy of an award.

2d. ***Trinidad Asphalt Pavements:*** The Trinidad Asphalt Pavements for streets, laid according to the several methods by "The Barber Asphalt Paving Company" upon concrete foundations, old stone block and other pavements, are adapted to all climates. They are remarkable for quantity, quality, ease of traction, noiselessness, ease of cleaning, sanitary value, economy of maintenance and handsome appearance, and are worthy of an award.

3d. ***Machinery and Processes:*** The models, samples, etc., show clearly and fully the Machinery, Processes and Materials for the manufacture of Asphalt Pavements and Mastics. They are worthy of an award.

Municipal Engineering

VOLUME XI. SEPTEMBER, EIGHTEEN NINETY-SIX. NUMBER 3.

THE NOMENCLATURE OF ASPHALT AND MINERAL BITUMEN OR PITCH.

By Leon Malo, Consulting Engineer, Pyrimont-Seyssel (Ain) France.

[Translated by W. H. Delano, Manager of the Compagnie Générale des Asphaltes de France, Paris.]

An eminent American chemist, Mr. S. F. Peckham, at a meeting of the chemical section of the Franklin Institute held recently,* brought forward again the question which has caused so much controversy lately in the United States, viz., the nomenclature of bituminous materials.

In a learned and ingenious debate, he did his best to restore to each material the name which best suits it, and indeed has given himself the trouble to insert a few new appellations for materials that do not yet possess any such. His labors, as regards the scientific and speculative standpoint, are of great interest, but as regards the industrial and commercial standpoint, his conclusions are not clear enough to finally close the debate. Yet, at an epoch like this, in which the employment of bituminous materials in the building trade has so marvelously extended, it would be well for the question to be settled once for all. Considerable financial as well as public interests are involved. Uncertainty in the terms employed may lead to regrettable confusion. Notably, the street-works of towns, for which such large quantities of bituminous materials are employed, may suffer from grave and costly mistakes, should the specification contain erroneous expressions, or clearness in expression not be complete.

The remarkable essay of Mr. S. F. Peckham, notwithstanding its erudition and good intentions, does not seem to throw any light upon the question. The chief points of the discussion are these: 1. What ought we to call asphalt? 2. What ought we to call bitumen?

In an opuscule, of which the first edition appeared in 1866 (and which had appeared in a notice printed in the *Annales des Ponts et Chaussées* five years earlier*), I first raised the question by calling attention to the necessity of giving to each material its fixed denomination, so that the same should not be left to the discretion of any newcomer.

At that time the use of bituminous products in public works was only just commencing; no one bothered himself about the variations in names, which were often quite fanciful, applied according to the caprices of those who employed the materials, or the imagination of the workmen who handled them.

Struck with the inconveniences

* Meeting of 15th October, 1895.

* *Annales des Ponts et Chaussées.* 1st Tract 1861.

of this confusion of tongues, I undertook, in 1861, to lay down a plan of nomenclature fully reasoned out, concerning all bituminous products used in building, but especially from a technical point of view, the chemical point of view being outside my competence. My memorandum was based on the following considerations:

The essential element of every bituminous product employed in street work or building is what several chemists have called maltha, and a few have called asphalt, but what the great majority of engineers, at one with commercial usage, have called bitumen or mineral pitch.

Bitumen is a mineral of a fine brilliant black color, viscous at the ordinary temperature of the ambient air, and which is found in its native state, more or less pure, in certain rocks of different geological ages and which can be extracted by dissolvents, like carbon di-sulphuride, turpentine, etc.

It would appear that this material, the product of a geological accident, the origin of which is still unknown, is nothing else but petroleum rendered pasty or consistent by slow oxidation.

It sprang up from the depths at an epoch probably contemporaneous with the pliocene formation, and arrived at the surface perhaps in the form of vapor to permeate the sand and the limestone around.

Bitumen no doubt took its name from a passage in the Bible about which etymologists have had many disputes.

When giving instructions to Noah for the building of the Ark, the Almighty spoke thus: "*Et bituminabis eam bitumine*" (and thou shalt pitch it with pitch). Probability is here at one with the text. It was, in fact, with mineral pitch made liquid by a slightly raised temperature that the Ark was smeared with pitch as wooden ships are smeared at the present day to keep them from rot.

We may add this other biblical circumstance, that, when the mother of Moses determined to abandon him on the waters of the Nile, she put him in a basket of wickerwork which she took care to smear with pitch—"*linivit eam bitumine.*"

We shall see later on how a third passage of the Bible is also opposed to the word bitumen, i. e., mineral pitch being confounded with asphalt.

I have said that bitumen, when springing up from the depths, got to permeate certain rocks. Most of these rocks, which are or have been utilized in industry, are silico-calcareous sands or compact limestone. The bituminous sands were formerly able to supply the bitumen used in public and private works. These sands were rinsed in boiling water, the bitumen rose to the surface, then it was skimmed off like the fat from a greasy soup. The skimmings were afterwards refined, and subsequently used for industrial purposes. Owing, however, to the high cost price of bitumen thus obtained, the process was abandoned.

On the contrary, the limestone thus permeated with bitumen has become the raw material of a considerable trade, becoming more important every day, and which now plays a preponderating part in the street work of big cities.

It is employed, as every one knows now, in two forms, either in powder, which powder, being heated and subsequently spread over a solid, dry concrete foundation and rammed down hard, makes the compressed asphalt for roadways, or by melting it in special boilers

with the help of bitumen as a fluid, and a certain proportion of grit, and spreading the mixture thus obtained in thin layers on a concrete surface, it becomes *liquid* asphalt, used principally for sidewalks.

The second of these applications is an old practice. The first was in the bloom of its novelty when, first of any, I proposed the nomenclature which has been sanctioned by use in Europe, but which has been so much discussed in the United States.

However, as the Bible has been ransacked to produce arguments for the discussion, it may be remarked that the Bible itself approves me. In fact, one may read with reference to building the wall of Babylon "*Et asphaltus fuit eis vice cementi*" (Asphalt was their cement).

It would have been impossible, with what we now call "bitumen," or mineral pitch, on this side of the Atlantic, and what a few Americans call asphalt, to make a cement for any building, particularly in a climate so hot as that of the east. If only a partial use had been made of it, at the first summer heat it (the so-called asphalt) would have melted and run down the sides of the walls, thus compromising the stability of the edifice. Such is absolutely unlikely.*

On the contrary, what I proposed to call asphalt, viz., bituminous limestone, ground, melted and used instead of mortar for masonry joints, will withstand the test of any temperature, and being completely impervious to water, not only is the solidity of the walls assured, but they are guaranteed from inner moisture.

There can be, therefore, no doubt about the matter. And if I lay stress upon the biblical quotations from which the American engineers draw their chief authority, it is because they show that Noah's Ark was lined with bitumen or pitch within and without, and that the walls of Babylon were certainly held together by liquid asphalt or asphalt mastic.

But, in my opinion, all this erudition is useless. We have no need to go back to the book of Genesis to settle a question of conventional terms required to give clearness to industrial and commercial transactions.

At a time when asphaltic products belonged almost exclusively to the domain of chemistry, and when each "savant" in his study or laboratory, each maker of a dictionary or encyclopedia, gave to such names more or less derived from the Greek, I set myself to simplify the nomenclature so as to avoid all misapprehension in the future.

Without foreseeing, thirty-seven years ago, what a place these products would take in public works, still I had a gleaming of their future importance, and I sat down to write the first monograph of asphalt which was ever written, taking care to give to each of the forms of these products the names which appeared to me to suit them logically.

I am not aware whether motives to be sought for outside their industrial character have induced innovators to change the classification indicated by me; it is possible that commercial interest may have been brought to bear upon the question, but this is beyond my competence. Still, no American publication I

---

* It is a fact that a house proprietor at St. Denis, near Paris, did build a house one winter, using pitch instead of mortar. As a Bible student he thought he was safe in following what he thought was the practice of the architect of the Tower of Babel. The walls fell down before completion, killing several people.—TRANSLATOR'S NOTE.

have read has convinced me that I am wrong.

I persist, therefore, in thinking that the system of nomenclature I published for the first time in 1861 in the *Annales des Ponts et Chaussées* has no need to be reformed, and that in the interest of clearness and precision in the special language of that industry, it is convenient to call:

First. Bitumen or pitch, the materials which impregnate asphalt.

Second. Asphalt — the calcareous rock, impregnated naturally by bitumen or pitch.

Third. Compressed asphalt or liquid asphalt — the asphalt laid on roadways, or the asphalt run in a liquid state on sidewalks.

LEON MALO, the distinguished asphalt expert of France, was born at Autun, France, in 1829. He is one of the old scholars of the *Ecole Centrale des Arts et Manufactures* of Paris. From 1853 to 1858 he was engineer of the *Chemins de fer du Midi, France.* From 1858 to the present, about thirty-seven years, he has been engineer and manager of the Seyssel Asphalt Mines. In 1869 he was named to the dignity of Knight of the Legion of Honor for his works and writings concerning asphalt. In 1889 he was honored with a gold medal at the International Exhibition for the same services. He is the author of the *Guide de l'Asphalte* and several other publications on the same subject.

STREET AND ROAD PAVING IN GERMANY.

By Robert Grimshaw, Ph. D., C. E.

In Germany and France far more attention is paid both to the roadbed and to the road covering than with us. This is partly an inheritance from the Romans, whose roads, built (I use the word advisedly) 2,000 years ago, are still good and usually better than our best of the present century; partly by reason of the greater cost of horseflesh, hence the necessity of using single teams where we would use double; and lastly, but not least, for military reasons. No one knows to-day what country road may have to bear the weight of artillery, nor what influence the passable or impassable condition of highway or byway may have upon the political geography of a continent. The sunken road at Waterloo, what hopes it dashed, what plans it changed!

I will in another article give examples of the best German usage as regards the cross-profile of roads and shall now indicate in a general way what methods are adopted for covering the roads once the profiles are established and the cuts and fills made. Where I say "roads" I mean "streets," and *vice versa;* for in Germany not only is the word "strasse" almost always usable for both, but the roads intersecting small towns are practically the same as the streets therethrough.

Roads here are classified into—

(1) GRAVEL AND CLAY.
(2) BROKEN STONE.
(3) SAND AND GRAVEL.
(4) STONE-PAVED.

(5) Brick-Paved.

And I shall take these up in the order named.

(1) *Gravel and Clay Roads.*—Country roads and cross-roads are covered at low cost with a layer of clay from two to four inches thick, for sandy districts, or of gravel or coarse sand where the foundation is clay. Slag and stone spalls are also used. As clay is so easily cut up in bad weather, when the road width is sufficient for two or more tracks, only half is covered with this facing.

(2) *Broken-Stone Roads.*—These are usually covered with one layer of coarse stone, and one or two layers of medium and small stone, or only with one or more layers of stone spalls. In either case there is first prepared a layer of earth as wide as the covered strip is to be, and as deep as the entire covering will be after rolling. For very heavily-traveled roads the stone covering is made thicker in the center than on the sides; in this case the earth layer is not proportionately thick in the center.

Formerly, before putting on the stone covering, the road was bordered with stones 8 to 10 inches long and wide and 6 to 8 inches high, to prevent spreading of the surface material; but as the advantage gained by this does not seem to balance the extra cost, this method has been largely abandoned.

Of course due regard is paid, in selecting the proper thickness of stone covering, to the nature not only of the traffic but of the underlying material.

For streets the thickness of the stone covering (after rolling) is 8 to 10 inches where there is no first layer of coarse stone, and, say, 8½ to 9½ inches where there is such under layer.

The under layer (Packlage) for streets consists of pyramidal stones, from 3½ to 6½ inches high, laid with their bases down, close together, and well pressed in.

On this under layer comes either the medium stones or the stone spalls, with a thickness of from 3½ to 4¾ inches, where there is but one layer above the under one, and 4¾ to 6½ inches where there are two layers. The spalls are for strong, sharp stone not over 1¾ to 1⅝ inches in diameter; for weaker material not over 1⅝ to 2 inches.

The under layers are rolled with light rollers, the upper layers with heavy; each layer, of course, separately. For "chaussées," or good stone-paved highways, the rollers are loaded with water, or otherwise; and weigh, unloaded, 5 to 6 net tons; loaded, 8 to 10 net tons. The rolling is done, first along the edges of the road, clear to the border stones, if there are any; and at each passage comes nearer to the center by the entire width of the rollers.

In dry weather the resistance offered to rolling, by the friction of the stones upon each other, is lessened by sprinkling; care being taken not to soften the material so much as to alter the profile.

In order to prevent the passage of surface water through the road-face, which would thus damage the road-bed and alter the road profile, each layer is filled, as laid, either with a water-tight bridging material or with some packing material. Up to a certain limit, the fine chips of the broken stone will serve this purpose; when they are not sufficient, resort is preferably had to iron sandstone (eisenschuessiger sandstein) and coarse sand. The binding material is applied after repeated rolling of the layers has brought them to a firm condition.

A well-rolled stone covering requires ¼ to ⅙ its volume of broken stone. As 0.8 cu. yd. of quarry stone yields on an average 1 cu. yd. of broken stone, there is needed, of quarry stone, 1.1 to 1.3 times the required volume of road-covering.

When stone is very dear the cost is kept down by the use of very coarse gravel, instead of the middle and upper stone layers. In this case the gravel layer should be 0.4 to 0.6 the thickness of the entire road-covering.

(3) *Sand and Gravel Roads.* In districts where stone is scarce and dear, but sand and gravel are found in plenty, these are used alone, with great success for high roads. The same general principles are applied as in the use of stone as a road-covering, but each layer is from ¼ to ⅓ thicker than for stone.

Where the gravel is not sharp, but round, a firm covering can be made only by the use of a binding material. When there is no such material found with the gravel, clay may be resorted to. After the gravel and clay have been well mixed by rakes or harrows, the road is rolled.

(4) *Stone-Paved Roads.* — Such roads consist of the bed proper and the paving. For the latter there is usually chosen the material which by its hardness and durability, and capability of being broken or cut into regular blocks, has given the best results; and this is granite stones as basalt, which soon wear slippery, especially where the traffic is great.

According to the shape of the paving-stones such roads are divided into:

(*a*) Rubble, of common stones as found, without any preparation. This paving is only used in village streets and the like. The stones are sorted according to size, and laid in strips, all of a size together, and as closely as possible. Preferably all the large stones are placed in the center of the street and the small ones at the sides. In any case, stones of a size are put together, so that there is not produced that effect, so common in America, of unevenness, caused by the small stones sinking in farther than the large ones, and thus making the street look like a relief-map of the Himalaya region.

(*b*) Ordinary quarry-stone, of stones of which at least one side, the upper face, is hewed. Here, also, the stones are sorted according to size, and laid as closely as possible in parallel strips (in which all stones are of a size), crosswise the street; care being taken to break joint in the direction of the street's length. The interstices are filled with gravel or sand.

(*c*) Hewed stone. The value and cost of this pavement are in proportion to the number of faces that are hewed, and to the care in their working.

The bed for all paved stone roads is of gravel or sand, sharp and free from clayey, marly, and vegetable material. The thickness of the bed depends on the amount and character of traffic and on the excellence of the facing. The most usual thickness is six inches. According to the impenetrability and thickness of the bed, the paving is laid from 1⅝ to 2⅞ inches higher than called for by the surveyor's plans, and then after due sprinklings and rammings, brought to the required level. The paving is then strewed from ½ to 1¼ inches thick with gravel, and this is well swept and washed deep into the interstices.

(5) *Brick.* — In such districts as East Friesland and Oldenburg, where stone is very dear, the roads

are paved with extra hard-burned bricks (called "klinkers"), which are smaller than those used for building.

The klinkers are set on edge, on a sand bed 12 to 16 inches thick, in parallel rows running crosswise of the street, as closely as possible, then rolled or rammed and the joints well filled with sand by sweeping and washing. Special care is taken with the bed, in order that the street, when finished, shall present an even profile and surface and be in accordance with the surveyor's plans.

Glazed, bent, twisted or blistered klinkers are not employed.

ROBERT GRIMSHAW was born in Philadelphia, in January, 1850, of English and French parentage. On his father's side he is of an industrial family known in Lancashire since 1100. His grandfather's cousin, Robert Peel, invented calico printing, and the family established immense linen weaving and cotton printing works near Belfast, while a cousin is to-day one of the principal designers of ocean racers in that city. He received a thorough scientific education in private schools and colleges, and took up mechanical engineering in the Delaware River Iron, Ship Building and Engine Works, Chester, Pa., under Reaney, Son & Archbold. Since 1873 he has practiced as scientific expert and consulting engineer in America and Europe. In 1878 he was one of the jury of awards at the Paris International Exposition; and in that year and 1879 traveled through Europe obtaining information for our own government and that of New South Wales. He has found time to write several books on the steam engine and kindred subjects, for practical men, and to contribute largely in English, French and German to the leading technical periodicals. He was one of the founders of the American Society of Mechanical Engineers, and has been admitted to membership to various other engineering societies, besides being president two terms of one of the lodges of the National Association of Stationary Engineers. He has latterly spent much of his time in the industrial centers of Europe as consulting and constructing engineer, introducing advanced American ideas, and more recently acting as representative, on the continent, of the International Permanent Exposition in New York. He has at the same time been engaged in gathering information regarding public work in European cities for use in a series of special articles to appear in MUNICIPAL ENGINEERING.

SOME NEGLECTED POINTS IN MUNICIPAL WORK.

By H. K. Landis, E. M.

Specifications are usually drawn up by an engineer for the information and direction of a contractor, and therefore should be brief, direct, and written in plain English as devoid as possible of legal phrases and technicalities. A scale drawing illustrating all the construction to be bid upon should accompany every set of specifications, and no pains should be spared in giving the contractor all necessary information. A neglect of these points is often the source of great annoyance subsequently to the engineer and expense to either his employers or the contractor. The specifications should be submitted to the city's attorney and to some one who has had practical experience in the work specified, for their criticism, before sending out.

Water, when used for sprinkling or flushing brick or asphalt, does no appreciable harm when the street is well drained. Water

should not stand in pools on asphalt for any length of time, however, for it then injures its wearing quality appreciably. Brick will absorb about 1½ per cent. of water, but a well vitrified brick is so strong and the pores are so small that it does not scale after being frozen. When water freezes in cracks in the pavement, however, or gets into the sand cushion, the results will some day call for a repair gang and the cost of maintenance increases. An oft neglected feature in specifications for paving is subdrainage. A loose sandy soil will drain itself, but when it is of a clayey nature, especially when located near higher ground, it is liable to retain water, and with an excess to form a foundation with soft spots in it. Although 4 to 6 inches of concrete is sufficient to distribute pressure over a firm bottom, it was never intended to act as a bridge, and consequently sags, forming hollows and cracks. We see such hollows in telford and granite blocks where the surface water soaks through the paving to the soil foundation; on a clay foundation, telford pavements, subject to heavy traffic, are often simply imbedded in clay, the yellow earth being squeezed up to the surface. When the earth foundation of brick or asphalt becomes soaked with water one of two things may happen; either a heavy load will depress the paving, or it may freeze during winter, thus raising the pavement or depressing the soil, leaving a hollow space in either case into which the first heavy dray presses the pavement. Examples of such hollows are not very numerous with well drained streets, but have been the cause of condemning many brick and asphalt streets before engineers realized the necessity of an unyielding foundation. The first brick were laid on planks 23 years ago and are still doing service, although they could not be sold under present specifications.

In fact, the worst enemy to street paving is poor foundations; earth has sufficient bearing power when dry, but is a poor support when wet, and that is the reason why the soil foundation should be drained. With cement-filled joints and bricks rising to the curb, brick pavements will not let water through, so that there is underground drainage principally to take care of. Some specify a two inch layer of sand over the earth and under the concrete, but this is of doubtful utility. Columbus, Ohio, requires a subdrain 4 inches in diameter, laid 2 feet from curb lines, and 1 foot beneath sub-grade, with branches to the center; when cement grouting is used between the bricks, one line of drain tile along the center of the roadway and sunk one foot into the soil is deemed sufficient; all drain trenches are filled with screened gravel. This insures at least one foot of firm soil. Foundations, like wells and soldered joints, want to be well made, for they can not well be inspected afterward.

The brick paving put down last autumn in Brooklyn, N. Y., as well as previous instances in other cities, gives forth an unpleasant rumbling sound, as if it were hollow, due to the cement foundation and sand cushion on top of it being frozen before the brick were laid. Cement *will* freeze. Therefore, do not lay concrete foundations during freezing weather.

If those who ride a wheel will make it a point to traverse streets the less frequented by teams they will there receive a pertinent object lesson. When a water or gas pipe leaks, a new pipe is to be laid, or a

pipe is to be cut out, the granite blocks are torn up, the earth thrown back into the trench with some little ramming, and the blocks replaced in a pretty little mound four inches high; at the next house this had been done six months before, leaving a four-inch gutter; and as one skips over the mound and dives into the gutter with a sensation of riding a bucking broncho, one does not wonder why New York horses look tired. Such methods in city management are relics of barbarism. When a trench is dug, an ordinance should require it to be refilled by sand or some other material which will not settle, and the blocks, asphalt or bricks replaced as before. This evil, an unnecessary evil, is common to all forms of paving, but is particularly injurious to asphalt and brick.

The settling about manholes is especially destructive to brick paving, as by some peculiar coincidence wagon wheels prefer the edge of a manhole plate or that of a car track, and here the paving is the least supported. Consequently, uneven settling first occurs, then the wearing and breaking of the pavement. An extra thickness of concrete foundation should be specified around manholes, and granite blocks be laid in a row next street car rails.

COUNTY PARKS.

By T. H. McBride.

All of us in one way or another know something of the monotonous grind which makes up the life-long experience of by far the larger number of our fellow-men—on the farm, in the shop, in the mine, day after day, one unceasing round of toil, into which the idea of pleasure or freshness never enters. How many thousands of our fellow-men, tens of thousands of our women see nothing but the revolving steps of labor's treadmill, day in, day out, winter and summer, year after year, for the whole span of mortal life. This is especially so in the western states, where the highest ideal is industry, the highest accomplishment, speed.

Our rural population is wearing itself out in an effort to wear out labor-saving machinery. If you do not believe it take a journey across the country, anywhere through the west, and see how the people are actually living. They know no law but labor; their only recreation is their toil. Now, it is needless to say how abnormal all this is. We are as a people entrapped in our machines, and are by them ground to powder. The effect of it is apparent already in the public health, and will be the most startling factor in the tables studied by the man of science in the generations following.

Not to print too darkly the picture, attention may be called to the fact that rural suicides are not uncommon, and that the wives of farmers are a conspicuous element in the population of some of our public institutions. There must be something done to remedy all this, to preserve for our people their physical and mental health, and to this end, as all experience shows, there is nothing so good as direct

contact with nature, the contemplation of her processes, the enjoyment of her peaceful splendor.

If in every county, or even in every township, there were public grounds to which our people might resort in numbers during all the summer season, a great step would be taken, as it seems to me, for the preparation, not to say restoration, of the public health. We are proud to call ourselves the children of "hardy pioneers," but much of the hardiness of those pioneers was due to the fact that they spent much of their time, women, children and all, out of doors. All the land was a vast park, in which that first generation roamed and reveled. They breathed the air of the forest, they drank the water of springs, they ate the fruit of the hillsides while plum thickets were their orchards, and all accounts go to show that hardier, healthier or happier people never lived. Such conditions can never come again, but we may yet, by public grounds for common enjoyment, realize somewhat of the old advantages.

Again such parks as are here discussed are an educational necessity. Our people as a whole suffer almost as much on the esthetic side of life as on that which is more strictly sanitary. How few of our landowners, for instance, have any idea of groves or lawns as desirable features of their holdings. If in any community a farm occurs on which a few acres are given over to beauty the fact is a matter for comment for miles in either direction.

A county park well kept and cared for would be a perpetual object lesson to the whole community, would show how the rocky knoll or deep ravine on one's own eighty-acre farm might be made attractive, until presently, instead of the angular maple groves with which our esthetic sense now vainly seeks appeasment, we should have a country rich in groves, conformable to nature's rules of landscape gardening if not to nature's planting.

ALLOWABLE MAGNESIA IN PORTLAND CEMENT.

By Irving A. Bachman, Ph. D., D. Sc.

Below is given a review of investigations and discussions of the question of magnesia in Portland cement, since 1891, looking to the maximum percentage permissible without endangering the quality of the cement:

1891.

Proceedings Association of German Cement Makers, February 27, 28, 1891.

Dyckerhoff, Schott and Arendt report the work on the influence of the presence of magnesia in cement on the lines laid down by the commission the previous year.

Dyckerhoff made experiments with cement containing 1, 3, 4, 5, 6 and 8 per cent. magnesia and reports that those containing over 4 per cent. showed expansion after one year, and with over 5 per cent. the tensile strength decreased after the same time.

Schott and Arendt did not share in this view; Arendt stated that cements containing as much as 7.15 per cent. magnesia expanded no more than normal cements.

Schott pointed out that the raw materials used by Dyckerhoff had been passed through a sieve of 900 m per sq. cm., whereas 1600 was recommended by the commission and so used by the other members;

this explained some of the failures of cements high in magnesia. He further contended that the cement used in the law courts at Cassel, the failure of which was the resurrection of the magnesia question, was not Portland cement, not even a magnesia Portland cement. The grinding was very imperfect, pieces of limestone as large as peas being scattered through the mass.

The result of the discussion as regards magnesia was that 3.5 per cent. was harmless, but no ruling was made as to what amount in excess of this was injurious.

Dyckerhoff* continued the investigation on cements of the following composition:

	1	2	3	4	5
Insol residue	0.7	0.47	0.79	1.14	1.41
FeO_{23}-AlO_{23}	10.74	10.25	10.34	9.37	8.67
CaO	62.50	59.12	55.44	50.56	47.28
MgO	1.93	6.23	11.36	17.80	21.14
Loss on ignition	0.8	1.24	1.11	1.16	1.50
SiO_2	21.46	20.48	19.42	18.31	18.71
Sp. Gr.	3.159	3.169	3.219	3.251	3.251

The increase in tensile strength was practically the same for samples containing 1.93 and 6.23 per cent. magnesia. After one year there was a slight retrogression of the sample containing 6.23 per cent.

In expansion the sample containing 6.23 per cent. magnesia was nearly parallel with that of normal cement.

For the samples containing over 6.23 per cent. magnesia the expansion appears to be very rapid and continuous.

These tests were all made neat and of course give no expression of what would take place when mixed with a large quantity of neutral material.

1892.

Proceedings Association of German Cement Makers, February, 26-27, 1892.

The work of the commission was based on cements containing 4.5 and 6.5 per cent. magnesia, but the board reported that it would be necessary to continue the work in order to ascertain whether they showed a retrograde tendency in the course of time. The question of permissible limits of magnesia was not decided and was referred back to the committee.

Carey* says, "Summing up the facts of which indisputable evidence has been produced, it may be stated that an excess of caustic lime or magnesia causes first, disintegration by expansion due to hydration, and second, being soluble, when conditions permit of their washing out, leave the concrete in a honey-combed state."

Dr. Michaelis† recommended that a cement containing over five per cent. magnesia should be avoided, but subsequently stated‡ that magnesia was practically only an adulterant and in its presence a correspondingly increased percentage of lime should have been added to the raw material in the manufacture. He does not consider it proven that a cement with five per cent. or more magnesia should on that account be rejected. Cement tests in which magnesia was present to the extent of twenty per cent. were under his observation for ten years and showed no signs

* Thond. Zeit. 14, 452.

* Ins. Civ. Eng., Eng. 107, 1891-1892.

† Das Wesen und der Erhartungs, Process dess Port Cementes.

‡ Wochenblatt for Baukunde.

of flaw. Tests made by him of correctly composed and properly burned cement containing eighteen to twenty per cent. magnesia have shown no greater expansion than normal cements.

Faija* considers that magnesia causes the lime in the cement to combine with the silica and alumina at a lower temperature, leaving the magnesia in a caustic state, which expanded on hydration. He thought that three per cent. was maximum for safety, though he had made cements with five per cent. magnesia which was perfectly good.

1893.

Annual Meeting Association German Cement Makers.

Dyckerhoff, Schott and Schifner again continue the investigation on magnesia. The result of the unfinished work on that subject referred back to this committee in 1892 was now reported. Dyckerhoff made some further experiments on samples in which lime was replaced by magnesia as high as 17.8 per cent. magnesia, in which the co-efficient of silica to lime was 1, 2.0, 1.8, 1.6 and 1.2. The three first represented by the co-efficients 1 : 2.0, 1 : 1.8 and 1 : 1.6 expanded so rapidly that after four to five years broke up completely, the fourth with co-efficient 1 : 1.2 after three years had a tensile strength of 16.6 kilograms, at four years 14.1 kilograms.

The samples affording 6.23 and 11.36 per cent. magnesia gave the following tensile strength:

P. C. MgO.	1 week.	4 weeks.	13 weeks.
6.23	9.4	17.6	22.0
11.36	3.3	6.9	14.2
	26 weeks.	1 year.	2 years.	3 years.
	23.4	21.4	17.7	18.7
	16.2	14.5	13.0	10.5

Weights given in kilograms.

* Inst. Civ. Eng., 107, 117.

Schott and Schifner's investigations do not agree with those of Dyckerhoff, but have been carried on for a shorter period of time; still for the same time their figures are not all concordant.

In the discussion of this subject Dyckerhoff states that 3 to 3.5 per cent. magnesia is not injurious. Schott maintains that 5 per cent. is positively not detrimental.

The meeting adjourned with the following ruling on magnesia in cement:

*The Magnesia Commission finds after a two years' test that a magnesia content of 5 per cent. in burnt cement is harmless.

Erdmenger† investigated this subject in great detail and shows that a high percentage of magnesia behaves badly, but the author says it can not be stated that 4 per cent. is the maximum permissible. ("Es kann aber nicht gesagt werden, dass diese Schadlichkerlsgrenze by etwa 4 pro. C. liegt.") He starts with a composition of the basic co-efficient

$$1.85\left\{\frac{\text{CaO MgO}}{\text{Sio RO}}\right\}$$

increasing the percentage of MgO from 0.8 to 23.3.

The cements tested had the following compositions:

No. 1.	*4*	*7*	*10*	*13*
63.5 CaO	61.4	60.0	57.0	52.0
.8 MgO	4.6	6.4	11.5	19.2
23.1 SiO_2	22.4	22.0	20.8	19.0
10.1 RO_{23}	9.6	9.2	8.7	8.0
bas. Co-eff. $\frac{\text{CaO}}{\text{Acid}}$	1.91	1.92	1.95	1.93	1.92
bas. Co-eff. $\frac{\text{CaO x MgO}}{\text{Acid}}$	1.94	2.06	2.13	2.32	2.64

*Die Versamnling mimnt daron-kentniss das die M. Commission ermittelthat, dass ann Gehalt von 5 Pro. C. Magnesia in gebrauntern Cement nach zweijahriger Untersuchingsdauer zu keinerlie Bedenken Anlass gibt, und achleisst sich dieser Ansicht an.

†Bericht uber Untersuchungen betr. Wirkung der Magnesia in Portland Cement. (Hanover, 1893.)

TENSILE STRENGTH, 1 PART CEMENT 3 SAND. IN KILOGRAMS FOR 1 Q.

No.	*1 Wk*	*4 Wks*	*13 Wks*	*25 Wks*	*50 Wks*	*90 Wks*	*P C MgO*
1	18.0	22.5	....	26.3	34.1	37.8	4.8
2	15.5	23.4	....	28.0	33.0	36.1	3.8
3	14.8	20.0	28.3	29.7	30.5	33.1	4.1
4	14.3	20.1	22.8	25.8	28.3	32.4	4.6
5	13.5	19.4	....	27.3	29.6	31.0	5.0
6	13.6	16.9	21.5	25.8	32.0	31.3	5.7
7	11.0	18.5	22.0	27.0	32.7	30.4	6.4
8	17.6	20.8	30.0	30.5	29.8	26.0	7.6
9	11.0	16.5	....	20.8	22.5	20.0	9.1
10	11.2	15.5	14.5	18.0	22.3	18.3	11.5
11	14.0	17.5	21.3	22.5	19.4	16.8	13.2
12	12.1	14.8	18.8	16.6	15.0	13.8	15.4
13	9.0	12.4	13.2	16.1	13.0	11.4	19.2
14	6.0	10.0	13.0	14.1	11.0	8.4	23.3

In the high pressure boiling test the behavior was as follows: This test as carried out by the author is very severe and many so called normal cements behave precisely as those with a magnesia content of over 10 per cent.

Magnesia content.	At 3 atmospheres.	6 atmospheres.	10 atmospheres.	20 atmospheres.
0.8 p. c.	12.0 k.	20.0 k.	27.7 k	32.3 k
3.8 "	10.0	18.0	33.0	23.5
4.6 "	9.0	17.0	28.0	23.0
5.7 "	9.0	14.0	18.5	Swelling.
6.4 "	6.0	11.5	(Showing swelling.)	do.
9.1 "	(Considerable expansion and swelling (soft).			Soft and swollen.
11.5 "	do.			
13.2 "	(Swelled rapidly, boiled to pieces.	(Disintegrated after rapid swelling.	(Disintegrated after rapid swelling.	do.
15.4 "				

The wires show that CaO as well as MgO swells and softens.

The author closes his paper with the statement that the behavior of cement is not dependent upon its magnesia content, but upon its chemical combination.

F. Kalalewski's* researches cover more years than those of any other investigator, and the results are tabulated as follows:

No.	MgO	CaO MgO $CleO_3$	CaO MgO $degO_3SeO_2$	SiO_2 / Al_2O_3	
1	23.6		3.13	1.86	Expanded very little—After 4 yrs. expanded.
2	20.0		2.15	1.18	
3	18.0		1.35	1.40	Swelled rapidly—After 90 days fell to pieces in drying—After 1 year rapid swelling.
4	17.0		1.81	1.49	No swelling—After 10 yrs. hard and intact.
5	17.3		1.84	1.63	Swelled a trifle—Some expansion up to 8 yrs. —after 10 yrs. no expansion.
6	18.5		2.50	3.99	Swelled rapidly—After 8 yrs. only the larger pieces held together.
7	——		1.92	2.27	Volume constant—After 10 yrs. still good.

We note that where the basic co-eff. is maintained to what we believe to be the best composition the samples show very little expansion and after ten years remain hard and intact, regardless of the high percentage of magnesia.

Grauer† cites the personal knowledge of cement used in 1865 and 1867 containing 4.57 and 5.07 per cent. magnesia used in a very damp garden wall that has held unusually well and shows no sign whatever of disintegration.

Schott‡ experimented with cements containing 3.5 to 8.0 per cent. magnesia, using Bauschinger's expansion apparatus; he found that up to 6 per cent. of magnesia the tensile strength remained the same.

Cements containing 7 to 8 per cent. of magnesia gave a slightly

* Ueber das Verhalten der Magnesiacemente in der Praxis.

†Dingler, 291.

‡Topfer Zeit. 1893.

greater expansion than those magnesia free, only in neat tests. The same cements with three parts sand gave no greater expansion than normal cements.

Meyer's* research was made on the basis that magnesia replaces lime; his tests seemed to show that the decline in the tensile strength of cements high in magnesia did not appear for a long time in cements tested neat. His cement containing 6 per cent. magnesia remained normal in every particular.

Schiffner† found no unusual behavior in cements containing magnesia over that of normal cements. Cements with 6.97 per cent. magnesia tested neat showed an expansion of 0.08 millim; from 11 to 14 months no expansion whatever. Cements with three parts sand showed only 0.045 millim in four months, and from 4 to 13 months no further expansion.

1894.

Proceedings Association German Cement Makers, February 23-24, 1894.

‡ This commission ruled that after a three years' investigation the tests show no injurious effect from a magnesia content of 5 per cent. in burnt cement.

§ The commission, including Camerman, Casse, De Schuyler, De Siblle and Pineur, appointed by the Brussels section of engineers to determine rules for classification and tests of hydraulic cement laid down no rules in reference to magnesia content.

*Thoind Zeit. 1893.

†Jahr Ber Pol. 1893.

‡"Die bez commission hat beschlassen" "Die commission halt nach ihren Versuchen, welche sich nur zum geringen Theil bis auf 3 Jahre erstrecken, eine schadlishe Wirkung der Magnesia bis Zu 5 proc. im gebraunten Cement auch bis jetzt nicht erwisen."

§ Annales de l' Asso. des Ingenieurs sortis Ecoles Speciales de Gand.

*A technical review of cement by Dr. Dybinsky covering the subject from 1891 to 1894 has the following to say about magnesia in cement:

As in previous years we have a vigorous prosecution of the investigation of this subject; a number of new authors have taken up the subject in great detail.

Summing up the matter, he says all investigators agree that 5 per cent. of magnesia in burnt cement is harmless. No maximum limits of safety have been defined.

The laborious and painstaking researches of Erdmenger show that magnesia, per se, is harmless, acting indifferently like so much sand. The trouble, he states, is overcome if the equivalent of magnesia is added as lime; then the supposed injurious effects of magnesia disappear.

1895.

Proceedings Association German Cement Makers, February, 1895.

Schott, Meyer and Arendt report that the investigation covering five years failed to show an injurious effect of magnesia in Portland cement.

The presence of magnesia up to 10 per cent. causes no harmful expansion or cracking of the cement, even after several years. Dyckerhoff reported no change in cement with a magnesia content of 3 per cent. Above 4 per cent., if sintered, whether added or substituted for a part of the lime, it has an injurious effect after long periods. If not sintered, however, as much as 18 per cent. may be present without exhibiting any bad effects.

He recommended the continuance of the allowable limit as for the previous year, namely 5 per cent.

The commission ruled that 5 per

* Dingler's, 294-89.

cent. be continued, but that the matter be held under advisement and that further research on the subject may change the former ruling and name a higher percentage of magnesia as a harmless content.

Briefly reviewing the situation, we have the views of LeChatlier, who regards magnesia as functioning similarly to lime and that of Erdmenger who considers it inert, acting indifferently like so much sand; the latter views are supported by very voluminous tables, being the result of very laborious and painstaking experiments covering many years.

Before the subject was critically investigated it was customary to charge all failures of cement to magnesia content, whether such failures were caused by its chemical composition *per se*, or by the final manipulation of the product by the consumer. So firmly had this become fixed into the minds of engineers and consumers in general that Russia, in giving out its official specifications for cements rejected everything over 2.5 per cent. magnesia. This ruling was followed by the other countries, which then led to a rigorous investigation of the subject. We find that in 1891 the maximum permissible was named at 2.5 per cent. In 1893 the ruling of the Association of German Cement Makers was that five per cent. was harmless. In 1894 we find the limits of maximum magnesia disappearing from most of the official specifications abroad. In 1895 the commission of the Association of German Cement Makers hold the matter under advisement, feeling that further research will place the limit of safety much higher.

Dyckerhoff, who has wielded the battle-ax against magnesia in cement more vigorously and persistently than any other investigator, has from year to year raised his limit of safety, and in his last report before the association states that as high as eighteen per cent. may be present if the product is not sintered; that is, if there are no incrustations or locking up of improperly burned material.

Summing up the situation we find that cement of the average composition and burning exhibits a tendency to blow when the percentage of magnesia reaches 11.5 per cent., but in mixtures of cement and neutral material as in actual use, no such blowing is observed under 15.4 per cent.

The naming of 2.5 per cent. magnesia as a maximum by some engineers in recent specifications in this country is purely arbitrary, based on no facts and supported by no proof that magnesia present to the extent of 2.5 or even five per cent., has or ever will create mischief.

From investigations* on this subject carried on for a number of years, I am satisfied that the percentage of magnesia within six per cent. has very little to do with the behavior of cement. There are other and more important conditions that change its character and particularly that of constancy of volume.

---

* Will appear shortly.

THE following is from the pen of Dr. A. D. Jacques, author of "Chemical Industry in America": "Irving A. Bachman was born in Northampton county, Pa., in May, 1864. His father is a descendant of the Bachmans who settled near Freemansburg, Pa., before the Revolution, and on his mother's side, who was Ansenetta Becker, he comes from a long line of distinguished scholars, especially in medicine and theology. His great-grandfather, Rev. Dr. Becker, was probably the most distinguished divine of the Re-

formed Church. The subject of the sketch spent his boyhood days in Catasauqua, Pa., where his father was a builder, and later moved on a farm in Northampton county, near Kreidersville, where some years were spent. He then taught school near his home for two years, in the meanwhile preparing for college, entering Muhlenburg College in 1883, but left before completing the course for the University of Virginia, where he graduated in 1887 with the highest honors. He continued post-graduate work here, and non-resident at Harvard, receiving the degree of Doctor of Philosophy in 1889 and 1890. In 1887 he went south in the capacity of chemist to the Georgia Chemical Works, where he rose step by step to general superintendent and chemical director. This position he resigned early in 1895, and removed his laboratory to his former home, at Allentown, Pa., the heart of the Portland cement industry, in order to devote his time exclusively to the cement industry. In 1892 and again in 1894 he declined the chair of chemistry, University of Georgia. For original research and high scientific attainments the degree of Doctor of Science was twice conferred on him in 1895. The subject of cement has had Dr. Bachman's constant attention, forming even a part of his post-graduate work, and he stands to-day better acquainted with the Portland cement industry, practically and theoretically, than any other man in America. His investigations are marked by the most striking originality, showing endless resources and great analytical skill, and he has been a very large contributor of scientific papers of a technical character to chemical journals."

THE PHILADELPHIA CONTROVERSY OVER PORTLAND CEMENT.

We are in receipt of a letter from Mr. W. J. Donaldson, referring to the statement by Messrs. Booth, Garrett & Blair, published in the August number of MUNICIPAL ENGINEERING, that the Alpha Portland Cement Co., though its president, had disavowed responsibility for Mr. Donaldson's statements, in connection with the controversy between him and Booth, Garrett & Blair over the Alpha Portland cement furnished for the Presbyterian House in Philadelphia. Mr. Donaldson says, "It appears to me by this that they desired to give the impression that any statements I may make in reference to cement would not have any weight whatever with the Alpha Portland Cement Co. In order to remove such an impression, which is entirely erroneous, I respectfully submit to you herewith a letter which I received from the president of the Alpha Portland Cement Co., bearing date of August 6." The letter to which Mr. Donaldson refers reads as follows:

In reply to your request we beg to write you in reference to the controversy between yourself and Messrs. Booth, Garrett & Blair, relative to the percentage of magnesia in cement, and incidentally the dispute with Messrs. Booth, Garrett & Blair relative to the Presbyterian Building.

We entirely approve of your efforts of having the percentage of magnesia allowable in American Portland cements raised to 3½ per cent. from the standard of 2½ per cent. adopted in the specifications of the Presbyterian board building, which specifications, we understand, were drawn by the architect, but were based on a *pro forma* set of specifications, put out by Mr. Lewis, of the firm of Booth, Garrett & Blair.

We are convinced from practical results obtained with our cement and other American cements containing over two and one-half per cent. of magnesia, but less than three and one-half, that the latter percentage is not a detriment to American cements produced from the materials found in the Lehigh Valley. These cements have proven too satisfactory in regular use to permit of their condemnation on theoretical grounds. We will gladly assist you in any proper way in bringing about the correction of specifications containing the two and one-half per cent. clause.

Second, with regard to that portion of the controversy which seems to be of a personal character, we beg to state that our understanding is as follows: Some time in the first half of June you addressed to Mr. W. W. Allen, chairman of the building committee of the Presbyterian

building, a letter relative to the use of our cement in their building, its use having been prohibited by the architect, because, upon analysis, some cars were found to show over two and one-half per cent. of magnesia. This letter we did not see until after you had forwarded it, when a copy was exhibited to us.

We have received a letter from Messrs. Booth, Garrett & Blair, dated June 15, reading as follows:

Mr. Geo. E. Bartol, President Alpha Portland Cement Co., Bourse Building, Philadelphia, Pa.:

DEAR SIR—On June 2 we addressed you a letter in regard to magnesia in cement in accordance with a request, which we understand came from you, to know whether or not we were disposed to advocate changes in your contract for the Presbyterian board building on this point.

We are advised that a letter has been addressed to Messrs. Wm. J. Donaldson & Co., sole agents of the Alpha Portland Cement Co., to Mr. W. W. Allen, chairman of the building committee of the Presbyterian board building, which quotes this letter of ours to you in full, and after grossly misstating our position makes a personal attack on this firm, because cement which failed to meet specifications under which it was sold was not accepted. We desire to know whether the Alpha Cement Co. is responsible for Mr. Donaldson's action in this matter, or if not, if such responsibility will be disavowed.

Yours respectfully,

(Signed) BOOTH, GARRETT & BLAIR.

You will note that this letter makes several charges, viz.: that your letter to Mr. Allen grossly misstated the position of the writers and made a personal attack on the firm, and that in consequence the writers desired to know whether we were responsible for your letter. As we had not seen your letter until after it was sent, and had quite forgotten its details, we replied to Messrs. Booth, Garrett & Blair, under date of June 19, as follows:

Messrs. Booth, Garrett & Blair, Philadelphia, Pa.:

GENTLEMEN—We duly received your favors of June 2 and June 15. Replying to your first letter relative to the question of magnesia and the propriety of our company joining with the other companies in the Lehigh Valley in an exhaustive investigation of the safety limit for magnesia in Portland cement, we beg to say that we have given this matter careful consideration and believe it to be desirable that the question should be determined by a carefully conducted investigation, and at the first favorable opportunity we will take up the matter with the other companies in the business and learn their views in the matter.

We have been somewhat unsettled as to the safe limit by what we have read as to the attitude of the German cement manufacturers, and also by your own printed circular received by us on the 12th inst., wherein in describing the qualities necessary in Portland cement to be used for various purposes, you appear to permit a limit of four per cent. of magnesia when the sulphuric acid does not exceed two per cent.

Replying to yours of the 15th inst., we beg to say that this company is in no way responsible for any statements made by Mr. Wm. J. Donaldson to Mr. W. W. Allen, chairman of the building committee of the Presbyterian board building. As a member of the board of directors of this company, Mr. Donaldson has the right to read our correspondence, but the company in no wise shoulders the responsibility for his letters as a sales agent. Any misstatement that he may make in such capacity, he must be prepared to answer for himself.

Yours truly,

ALPHA PORTLAND CEMENT CO.,

(Signed) GEO. E. BARTOL, *Pres't.*

You will note that our disavowal of the responsibility for your letter applies only to the specific statement of Messrs. Booth, Garrett & Blair that your letter "grossly misstates their position and makes a personal attack on the firm." We understand that Messrs. Booth, Garrett & Blair construe our reply of June 19, to be a general disavowal of the whole question, and we therefore write this letter of explanation so as to state out position clearly.

You will note in our letter of June 19 a reference to a printed circular received from Messrs. Booth, Garrett & Blair in which the magnesia limit was raised to four per cent. for cement to be used on such work as the Presbyterian board building. We would state that we received a letter from these gentlemen dated June 20, requesting the return of the circular, which letter stated that the magnesia percentage in the circular was a typographical error, and that they had been compelled to call in all of the circulars sent out.

In conclusion we beg to say that we have the highest opinion of the character, ability and integrity of Messrs. Booth, Garrett & Blair, and that we can not take exception to their rejection of cement offered for use in the Presbyterian board building, when such cement contained over two and one-half per cent. of magnesia, as the specifications clearly fixed this limit, and these gentlemen acting professionally for the architect of the building, performed only their duty in the matter.

We would say further, however, that we are satisfied that careful investigation by them on this subject will undoubtedly result in changing their views as to the minimum percentage of magnesia, and we feel that this minimum will be raised to at least three and one-half per cent. and we trust in this effort to have their assistance.

We recognize the broad difference between the position of the firm as representatives of the architects employed to see that the goods delivered under the specifications, strictly comply therewith, and their position as analytical and testing chemists of great experience and ability.

Yours very truly.

ALPHA PORTLAND CEMENT CO.,
(Signed) GEO. E. BARTOL, *Pres't.*

COST OF ALTOONA'S FILTER BEDS AND SEWAGE DISPOSAL PLANT.

The contract for construction of the filter beds and sewage disposal plant at Altoona, Pa., was awarded on August 7th, to William H. Herr. Mr. Harvey Linton, city engineer of Altoona, sends us full details as to the specifications and bids, and a table is given herewith showing the complete bids, which were based on the engineer's estimates of quantities of work to be done, as follows:

BIDS FOR FILTER BEDS, ETC., SEWAGE DISPOSAL PLANT OF CITY OF ALTOONA, PA.

		Received Aug. 7, 1896.	Wm. H. Herr, Altoona, Pa.		J. S. Yigond, Altoona, Pa.		S. W. Frescolm, Reading, Pa.		A. M. Thomas, Lock Haven, Pa.		Thos. Martin, Altoona, Pa.		M. H. Smith, Altoona, Pa.		Kelly, Sims & Co., Philadelphia, Pa.		Orner & Shellenberger, Altoona, Pa.	
			Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't	Rate	Am't
a.	1440 lin. ft.		$ .15	$216.00	$ .16	$230.40	$ .16	$230.40	$ .25	$360.00	$ .25	$360.00	$ .25	$374.40	$ .20	$288.00	$ .27	$388.80
b.	84 cu. yds.		.50	42.00	.50	42.00	2.50	210.00	1.00	84.00	1.00	84.00	1.50	126.00	2.31	194.04	2.00	168.00
bb.	43 cu. yds.		.50	21.50	.50	21.50	5.00	215.00	2.50	107.50	1.00	43.00	2.50	107.50	4.08	175.24	3.25	139.75
c.	2444 lin. ft.		.08	195.52	.13	317.72	.06	146.64	.10	244.40	.10	244.40	.10	244.40	.09	219.96	.04	97.76
d.	2035 lin. ft.		.07	142.45	.11	223.85	.05	101.75	.10	203.50	.10	203.50	.10	203.50	.07	142.45	.04	81.40
e.	1905.6 lin. ft.		.06	114.34	.10	190.56	.03	57.17	.06	114.34	.06	114.34	.08	152.45	.05	95.29	.03	57.17
f.	1440 lin. ft.		.43	619.20	.38	547.20	.37	532.80	.40	576.00	.40	576.00	.42	604.80	.65	936.00	.50	720.00
g.	2304 lin. ft.		.35	837.90	.28	670.32	.30	718.20	.35	837.90	.30	718.20	.35	837.90	.55	1316.70	.35	837.90
h.	1989 lin. ft.		.25	497.25	.21	417.69	.23	457.47	.25	497.25	.25	497.25	.25	497.25	.35	696.15	.26	517.14
i.	1846 lin. ft.		.20	369.20	.17	313.82	.19	350.74	.20	369.20	.20	369.20	.20	369.20	.30	553.80	.50	369.20
k.	Three.		35.00	105.00	30.00	90.00	45.00	135.00	35.00	105.00	33.00	99.00	35.00	105.00	41.75	125.25	28.50	85.50
l.	One.		.....	100.00	.....	175.00	.....	90.00	.....	200.00	.....	35.00	.....	225.00	.....	137.46	.....	130.00
m.	34.		20.00	680.00	17.00	578.00	25.00	850.00	20.00	680.00	15.12	514.08	21.50	731.00	24.46	831.64	22.25	756.50
n.	84.		20.00	700.00	10.00	840.00	.....	600.00	.....	632.22	.....	574.75	.....	650.22	.....	652.00	.....	200.00
o.	One.		.....	130.00	.....	150.00	.....	180.00	.....	150.00	.....	150.00	.....	235.00	.....	179.00	.....	171.00
p.	200 lin. ft.		1.80	360.00	2.00	400.00	1.55	310.00	1.50	300.00	1.75	350.00	1.70	340.00	2.69	538.00	1.75	350.00
q.	120 lin. ft.		1.20	144.00	1.40	168.00	.85	102.00	1.10	132.00	1.00	120.00	1.05	126.00	1.65	198.00	1.00	120.00
r.	Two.		24.00	48.00	18.00	36.00	30.00	60.00	25.00	50.00	25.00	50.00	27.00	54.00	25.00	50.00	15.00	30.00
s.	30 acres.		7.00	210.00	6.00	180.00	10.00	300.00	10.00	300.00	6.00	180.00	11.00	330.00	12.00	360.00	4.00	120.00
t.	Lump sum.		.....	400.00	.....	300.00	.....	1000.00	.....	700.00	.....	500.00	.....	980.00	.....	340.00	.....	1000.00
u.	5800 cu. yds.		.13	754.00	.16½	9570.00	.16	9580.00	.16½	9570.00	.20	11600.00	.19	11020.00	.24	13920.00	.32	18560.00
v.	200 cu. yds.		.20	40.00	.25	50.00	.20	40.00	.50	100.00	.50	100.00	.50	100.00	.15	30.00	.25	50.00
w.	1200 cu. yds.		.50	600.00	.25	300.00	.20	240.00	.25	300.00	.25	300.00	.50	600.00	.75	900.00	.60	720.00
x.	300 sq. yds.		.50	60.00	.25	75.00	.25	75.00	.30	90.00	.50	150.00	.30	90.00	.30	90.00	.40	120.00
y.	200 sq. yds.		.40	80.00	.25	50.00	.50	100.00	.50	100.00	.50	100.00	.50	100.00	.75	150.00	.25	50.00
z.	20 cu. yds.		1.50	30.00	1.00	20.00	3.00	60.00	2.00	40.00	1.00	20.00	2.00	40.00	1.25	25.00	3.00	60.00
zz.	100 days.		1.60	160.00	1.75	175.00	1.75	175.00	1.75	175.00	1.25	125.00	1.60	160.00	1.50	150.00	1.40	140.00
	Total.			$14442.36		$16162.06		$16617.17		$17018.71		$18477.72		$19323.62		$23233.98		$26130.12

a. 1440 linear feet of earth excavation and refilling in trench three feet wide, for 18 inch pipe sewer; amounting to 757 cubic yards.

b. 213 linear feet of earth excavation and refilling in trench 33 inches wide, for 16 inch iron inverted siphon, crossing under river, including excavation for siphon chamber and screen tank; amounting to 84 cubic yards.

bb. 137 linear feet of earth excavation and refilling in trench 24 inches wide, for ten inch iron inverted siphon, crossing under river, including excavation for two siphon chambers; amounting to 43 cubic yards.

c. 2444 linear feet of earth excavation and refilling in trench 30 inches wide, for 15 inch terra cotta sewage carrier; amounting to 385 cubic yards, including extra excavation for twelve gate chambers.

d. 2035 linear feet of earth excavation and refilling in trench 27 inches wide, for 12 inch terra cotta sewage carrier; amounting to 246 cubic yards, including extra excavation for eleven gate chambers.

e. 1905.6 linear feet of earth excavation and refilling in trench 24 inches wide, for 10 inch terra cotta sewage carrier; amounting to 145 cubic yards, including extra excavation for twelve gate chambers.

f. 1440 linear feet of 18 inch pipe sewer.

g. 2394 linear feet of 15 inch sewage carriers.

h. 1989 linear feet of 12 inch sewage carriers.

i. 1846 linear feet of 10 inch sewage carriers.

k. 3 siphon chambers, 3′ x 4′, as per plans.

l. 1 screen tank, 5′ x 8′, as per plans.

m. 34 gate chambers, 2′ x 3′, as per plans.

n. 84 cast iron gates.

o. 1 special oval manhole, dam and gates as per plans.

p. 200 feet 16 inch cast iron siphon.

q. 120 feet 10 inch cast iron siphon.

r. 2 manholes on 18 inch pipe sewer.

s. 30 acres plowing, 12 inches deep.

t. Grubbing—lump sum.

u. 58,000 cubic yards excavation for grading filter beds and making embankments.

gh. 200 cubic yards of material in embankment, rolled in 6 inch layers.

ik. For picking out, hauling and placing 1200 cubic yards of stones over 4 inches long.

lm. For sodding 300 square yards of outside embankment.

no. For 200 square yards of cobble stone pavement.

pq. 20 cubic yards of rock excavation.

rs. 100 days' labor.

THE QUESTION DEPARTMENT.

[By J. W. Howard, B. L., C. E., for MUNICIPAL ENGINEERING.]

CLEANING PAVEMENTS BY FLUSHING OR SWEEPING.

Do you consider flushing or sweeping as the best method for cleaning asphalt pavements? If flushing, how do you advise it to be done? If sweeping, what has experience shown to be the best system?

James T. Bannon, Milwaukee, Wis.

With large sewers, a good water supply, and ample room for that which flows from the sewers, flushing the street pavements is the best method, either by hose from the fire hydrants, or by thoroughly drenching it with watering carts and pushing the rubber scrapers over the pavement immediately afterward; then flushing the scrapings with a little water from the hydrants or by pushing them slowly along with the rubber hand scrapers to the sewer openings. This, in brief, is the system of Paris and Berlin.

Sweeping asphalt pavements, however, is the only method at the disposal of most cities. What is known as the block system is probably the best method for cleaning asphalt pavements. It applies also to good granite and brick pavements. Men are stationed with scrapers, brooms, or the two tools combined in one, at intervals varying with the width of the street and the quantity of the traffic and hence in proportion to the amount of cleaning to be done. Receptacles in the shape of special hand carts, bags, or fixed receivers, make the work more efficient, although many streets are swept by the block system without receptacles. Small piles of the sweepings are placed temporarily at such points as are least objectionable at the sides of the street, until the carts coming

at intervals, take them up. Further details are not possible in this department of the magazine. See article "How the Streets of New York are Cleaned," MUNICIPAL ENGINEERING, Sept., 1895, p. 139. The street cleaning problem is one occupying the attention of the best minds in many cities.

FREQUENCY OF STREET CLEANING.

Will the editor of your Question Department please inform me how often the streets of Brooklyn are cleaned, compared with New York, as I am helping a movement to have our streets cleaned as thoroughly as those of New York?

W. T. McElveen, Ph. D., Brooklyn, N. Y.

The frequency of street cleaning in New York city was published in the June number of MUNICIPAL ENGINEERING, p. 403.

Brooklyn is not as well cleaned as New York, and figures obtained last spring show that there are 424 miles of paved streets, or thereabouts, of which 270 miles, or 64 per cent., are still paved with cobble stones, which Brooklyn endures to the injury of comfort through noise and of filth through the impossibility of thoroughly cleaning such pavements. Your streets are swept as follows:

29 miles asphalt pavements swept daily.
12 miles granite swept daily.
12 miles granite swept three times a week.
39 miles granite and Belgian swept twice a week.
31 miles granite and Belgian swept once a week.
130 miles cobble, granite, Belgian, swept three times a month.
170 miles cobble, Belgian, granite, swept twice a month.

The word Belgian means basalt or trap blocks, generally cut square. This word is obsolete although used by a few older inhabitants. Brooklyn expends $550,000 per year in attempting to clean her streets and remove the garbage and ashes. Possibly better results could be obtained from this money, but it is probable that it is not sufficient to properly clean the streets of that city.

PAVING CEMENT MIXTURE FOR JOINTS OF GRANITE OR BRICK PAVEMENT.

In the June number of MUNICIPAL ENGINEERING magazine I noticed in the answer to a question on "noise of brick pavements," that you mention mixtures of "bituminous cements for filling the joints of brick pavements." Please state one or more, and if they are suited for use in connection with gravel between granite blocks.

J. M. B., Contractor, St. Louis.

A standard bituminous cement used in many cities, including New York, is as follows: It is called paving cement in some places and is composed of 100 parts of No. 4 distillate of coal-tar, made by direct distillation, being the residuum of coal-tar bearing this number. To the 100 parts by weight of the prepared coal-tar, 20 parts of refined Trinidad asphalt and three parts of residuum oil of petroleum are added. The whole are mixed hot in kettles on the work at a temperature of 300 degrees. The resulting bituminous or paving cement is poured into the joints of the brick or granite pavement, generally from cans of sheet iron resembling large coffee pots. In some places a cone holding two gallons is used. The point of the cone is downward and has a hole in it. The cone is fastened to a straight wooden handle erect from its center.

There are other bituminous paving cements, but the above is the only one known to us which is not patented.

THICKNESS AND COST OF MACADAM ON COUNTRY ROADS.

In putting stone on dirt pikes (turnpikes or county roads) how thick or deep should the crushed stone be to last well? The information is for persons in Virginia who have limestone rock; which is considered the best?

J. K. Robinson, Cincinnati.

The answer must be in general terms, because no details of location, width of road, grade, drain-

age, sub-soil, amount of traffic, etc., are given. The thinnest macadam roads should not be less than eight inches thick, laid on a firm, dry soil, or one rendered so by drainage. Twelve inches would be sufficient in the suburbs of a city, or where travel is numerous or heavy.

Limestone rock is not the best stone to use for macadam roads, unless better stone is too far away to be had at but a slight advance in price over the limestone. The best stone for macadam road surface is trap-rock, called also dolerite or basalt; the next best are syenite, granite, then limestone. There is one form of limestone, found in a very few places, called compact-limestone or hard calcite, which is almost as good as trap-rock. Limestone generally solidifies quickly, but quickly disintegrates under traffic and weather.

Mr. Robinson also asked in regard to cost, but gave no price of materials, wages, or wagon hire; therefore, no answer can be given concerning cost, beyond saying that some eight-inch macadam roads, about nine feet wide, have been constructed in southern New Jersey, approximating the climate of Virginia, at about $7,500 per mile. This included regrading and preparing the old earth roadbed.

REPLACING EARTH IN TRENCHES OPENED IN STREETS.

Can you give me the form of an ordinance regulating the replacing of material dug from trenches in a macadam street, by water, steam or gas companies? This place is put to considerable expense because the material is not filled in properly, causing depressions which do not show for five or six months after the trenches are filled. Do you know of any place where the replacing of this material is put in the hands of the municipal authorities?

Wm. S. Pugh, Pottsville, Pa.

Most cities and towns compel this work to be done by the employes and at the expense of the company, plumber, or other person who has made the street opening. No city is known to us which has any one ordinance or detailed set of rules for replacing trench material. This is because the necessities vary with the different soils, locations, width and depth of the trenches. Most cities provide that some named general officer such as city engineer or superintendent of streets, shall have charge of such matters and have full discretionary powers in regard to the methods employed. Some cities, where there are different departments with chiefs at the head of each, such as sewer, water, and street departments, place these chiefs in charge of all details which it is not possible to commit to printed form of ordinance or regulation. The openings, whether made by city employes or those of companies having franchises, must be closed in a manner satisfactory to the proper municipal official under whose department the work is undertaken.

The reason of the failure to properly refill trenches and consolidate the material is generally that the chiefs of departments do not familiarize themselves with the principles involved. They generally assign this work to the common foreman and laborers; praising them if they quickly refill the trench rather than if they properly refill it.

With proper ramming, more material can be replaced in a trench than was taken from it, unless a new pipe is laid larger than the one previously there; or unless, in the case of a pipe being laid for the first time, it is quite large, *e. g.*, a sewer. In laying water and gas pipes no dirt should be left over, except with shallow trenches and large pipes.

The best rule for all soils is to replace the earth in layers of about six or eight inches at a time and

consolidate it by ramming. There should be at least two rammers to each shoveller, but safest four rammers to each shoveller. If the trench is very deep, care must be taken that, when one section has been refilled to the surface in layers and consolidated, the joint or slope on the face of the filling in the trench, when the next section is filled, shall be properly compacted.

As a rule flushing with water is bad practice for refilling trenches. If the soil be of clay, or contain much loam or broken stone, gravel and earth mixed, the mass becomes swollen with water, which within a few months slowly drains and dries out, with the result that the materials in the trench shrink and settle. Flushing is safe only in very sandy soil, when, however, as sand compacts but little, ramming would be as good and probably less expensive, especially considering the cost of water.

A permit in duplicate for each street opening should be obtained before any person could disturb your city street. No general permit should be issued. A deposit is required of from $15 upward for each permit issued in many cities. This deposit, a certified check, is returned when the proper official certifies on the duplicate permit that the street has been properly repaired according to an attached statement from the special inspector who viewed the work in progress and completed.

Companies are not free from responsibility if it can be shown, even a year or two after, that the defects in the street are due to imperfect refilling of trenches on their part. This has been decided in the courts at several places, under the common law. Such decisions have several times been the means of compelling companies to do their work anew, after an interval of several months and even years.

The right man in charge will save a city thousands of dollars of injury and much inconvenience.

THE DUTY OF ENGINEERS.

If an engineer in the employ of a company or other corporation is told that he must subordinate his professional judgment and technical study to the financial interest of the business managers, what should he do? *M. K. H.,*
Chief Engr. of—— Water-works.

He should do right. He should submit his reports and recommendations to his company, sustained by the recorded and other facts upon which they are based. To others, unless asked by his company, or summoned by lawful authority, he should remain silent. If ordered to undertake a construction which he knows to be weak, dangerous, or imperfect, he should decline in courteous language, best in writing, to his employers. No corporation can long exist, if it should fail to follow the written advice of scientific men, in matters of engineering or other construction.

THE PAVING OF FIFTH AVENUE, NEW YORK.

I notice in the August number of MUNICIPAL ENGINEERING that Fifth avenue is to be paved with asphalt. Is it to be laid over the present granite block, or are they to be removed and the concrete foundation, if such exists, used under the asphalt pavement? What is its present pavement and cost? *A. B. Peterson, Louisville.*

It is not to be laid over the present granite blocks. They and the concrete under them are to be removed, because new sewers and a few other new pipes are needed under Fifth avenue. The whole subpiping is to be put in order. The asphalt pavement will be laid by sections as fast as the sewers, etc., are finished, the earth replaced and properly consolidated by ramming

and rolling. The new pavement consists of Portland cement concrete foundation, a binder (or thin layer of asphalt concrete), and the usual asphalt pavement surface.

Fifth avenue was paved, except a small portion near 37th street, from 9th to 90th streets, during 1886, '87, '88. It consisted of a six-inch concrete foundation, two inches of sand and very uniform granite blocks, 4 to 4½ inches wide, 7 to 7½ deep, 10 to 12 long, joints filled with paving cement and gravel. The first set of officials and inspectors were removed in 1886 because of neglect of duty and poor work. This was corrected by trained men under the administration of the army engineer, Gen. Newton, then appointed Commissioner of Public Works. It cost $4.97 per square yard, the contractor getting the old stone which was removed. The maintenance for ten years has been a little less than $10,000 per year over the area of about 90,000 square yards, or four miles. The cost therefore, has been $4.97 plus $1.11 or $6.08 per square yard for the ten years. General repairs are no longer possible because the blocks are rounded and worn beyond repair. A new pavement is necessary. The city has chosen asphalt for this avenue from 9th to 59th streets, the work to be guaranteed for fifteen years, part being paid upon its completion and the balance to be paid at intervals beginning with the sixth and ending with the fifteenth year, the pavement to be kept in order and turned over in good condition at the end of the fifteenth year. The estimated amount to 59th street is 70,000 square yards under a fifteen year contract, at a little less than $4.50 per square yard. The portion from 59th to 90th streets being so far up town and having light traffic, the granite blocks are still good and will remain.

Considering the importance of Fifth avenue, its heavy, numerous, constant traffic, the cost of its pavements, and other statistics concerning its maintenance, carefully recorded for many years, this roadway forms the basis of many interesting comparisons in connection with street construction.

BRICK PAVEMENT STREET CROSSINGS.

What would be the cost and how would you lay a brick pavement across a street? My object is to have a continuous walk for pedestrians. *W. H. Eyer, Bloomsburg, Pa.*

Assuming that your sidewalks are flagged or otherwise suitably covered, and that you have curbstones, we would recommend the laying of carefully selected paving brick upon a four inch concrete foundation, putting about one inch of sand between the brick and the concrete below it. The concrete should be a mixture of one part of cement, two of sand, and four of crushed stone about two-inch size. Use as little water as possible.

Figure 1 shows general plan. The surface of the brick pavement crosswalk should be crowned at exactly the same degree as the roadway, which in your city is probably of macadam or gravel. The points

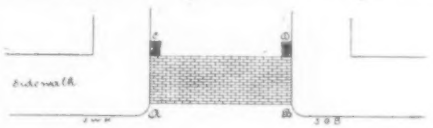


Fig 1

marked C and D consist of a little cobblestone pavement in the gutters, to prevent water undermining the crossing. The crosswalk should not curve in the direction of the street which it crosses.

Figure 2 is the same construction in the form of a picture. Care-

fully selected paving brick, when well laid with Portland cement grout in the joints, make excellent

Fig II

crosswalks in villages, towns and the suburbs of cities where macadam and gravel roads exist, and where it is now often disagreeable to cross because of mud or dust.

The cost in your city would depend upon the price of freight on the bricks. The amount of such work being limited makes the cost higher than for regular brick pavement. If several walks are done simultaneously you could probably get the work done for from 35 to 50 cents per square foot, which is a little less than the cost of heavy, well laid bridge stones or bluestone crosswalks.

EXPANSION OF BRICK PAVEMENT.

What was the cause of the break in the new brick pavement on Johnson ave. in our city? The pavement was pushed up in a ridge across the street, the center and ends of the ridge breaking in pieces.

D. Y., Roseville, Newark.

Fortunately this matter received the attention of one of the staff of MUNICIPAL ENGINEERING when it happened and photographs of the place were taken, which we reproduce in this connection.

View No. 1 is at the gutter on the east side of the street and shows how the bricks were forced upward. View No. 2 is the center of the street.

This pavement was laid late in 1895, on concrete, with the joints of the bricks filled with cement grout. The pavement, therefore, when finished, was in a contracted condition and so remained until the spring, when unusually warm weather steadily expanded the bricks. The expansion crosswise the street was resisted by the curbstones and their concrete setting, with no perceptible disadvantage to the pavement. But the expansion lengthwise the street forced the bricks down a slight grade for

VIEW NO. I.

a long distance to a point where the pavement for a short distance was level. The brick pavement was there forced upward in the form of an arch, with a hollow under it, extending with a few breaks across the street. The ridge or

VIEW NO. II.

crown of the arch was at right angles to the direction of the street. The brick at a few points gave way, as seen in the photograph. We learn, through the city engineer, that the expansion of the bricks

could be traced by the break along the curbs for a distance of a little more than 330 feet.

This accident teaches that it is not wise to lay brick pavements in freezing weather, especially when the joints are to be filled with cement grout. It is doubtful if it would be wise to use bituminous grout, or even sand in freezing weather.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

SEWER ASSESSMENTS.

How should assessments for sewers be made: according to frontage, according to area of lot, or according to value of lot and improvements, or should the city pay all? *E. F. C.*

Assessments are made according to all the methods named and some combinations of them. The most usual way is according to frontage. In such cases a corner lot may have two assessments, but it is usually so arranged that it will pay but one, usually that on the long side. It is evidently unjust that the abutting property should pay the whole cost of a main sewer draining a large district, and a portion of such cost is either assessed on the whole district to be benefited or is paid by the city. In Milwaukee it is expressly stated that such district assessments shall not be made and the city will pay the excess of cost over $1.60 a foot of sewer. In other cities all assessments are made according to area, the abutting property paying for local sewers and in case of main sewers the excess of cost over what a local sewer would cost being assessed over the whole district that will be benefited when the entire system draining into this main sewer is completed. Three objections are made to this method: one that, for example, a large hotel with a population of several hundred may be so situated as to pay a smaller assessment than the same area outside on which are located perhaps a half dozen cottages; another, that a lot may have many assessments—actually seven sewer assessments have been paid by a single lot; another that several assessments may be paid and the lot still have no sewer and will perhaps have none nor any need of one for years. If the city pays the whole cost of sewers and constructs them slowly, there is much complaint from the tax-payers who fail to get sewers in their districts. If the system is rapidly constructed this method would seem to be the best as the property would then pay for sewers according to its value and as nearly as may be according to its benefits. If the city pays for main sewers and the abutting property pays for local sewers, probably as fair an adjustment as possible in ordinary cases will be made. The proportion of the cost of the main sewer to be charged for local purposes can be determined by the excess over, say, $1.60 a lineal foot, or better by the excess over a sum, say 10 to 15 cents a square foot, since the area of a lot is more nearly a measure of its benefits than its frontage on a street.

USES OF CATCH BASINS.

Why are catch basins used to receive water from streets and discharge it into sewers, and why will not inlets directly to the sewer answer every purpose? *N. S.*

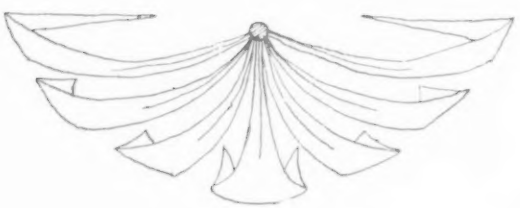
A catch basin as that term is generally used is used to hold the sand and dirt and other heavy material washed in from the street, leaving the water to run into the sewer. Its efficacy for this purpose

depends on its form and its size in relation to the amount of water entering in a short period of time. When basins are allowed to fill too full of debris, the material is run through the basin without stopping and the value of the basin is lost, as it then acts only as an inlet. Basins are of use where the sewers have low gradients and the material washed in from the street would be likely to stop in the sewer because the velocity of the current is insufficient to carry it off. If the sewers are in bad condition the basins are also of value. But if the gradients are steep and the alinement is good, the street material is not a serious detriment to the sewer and the current is sufficient to carry it off. In such case inlets are sufficient and the extra expense of basins is unnecessary. The heavy expense of frequent cleanings is also saved. Both inlets and basins are usually provided with some kind of trap to prevent sewer gas from getting to the street through them. Catch basins frequently give off offensive odors, on account of the decomposition of the matter in them, which are even more objectionable than the odors of sewer air.

HOSE AND PLAY PIPES OF FIRE ENGINE.

Why are four to six small lines of hose used to feed a large hose and play pipe from a single engine rather than one or two large lines? *G. W. C., Omaha, Neb.*

The large play pipe is to provide a large volume and force of water in a single stream. It must be fitted to take its place in the regular system of apparatus and must therefore be made to fit the ordinary hose in use by the department and the openings in the engine. Otherwise a special engine or special fittings must be provided. With several small lines of hose one line can burst without seriously interfering with the use of the pipe if proper valves are provided. Undoubtedly higher efficiency could be obtained with fewer and larger feeding lines.



BY WAY OF COMMENT.

Foundations for Street Pavements. Experience has shown that the foundation for the ordinary street pavement should consist first of well compacted earth, with all soft material removed and replaced with dry earth or gravel, and second, of a layer of concrete at least six inches thick. Engineers in some localities have omitted the concrete with good results, but usually the omission has been with the result of an uneven pavement, costing much more for maintenance than it should. There is no question that a natural material which is equivalent to concrete need not be removed to make room for that material, and where the natural foundation is fully sufficient it should be kept and put to its proper use. Even native rock is not always sufficient, however. The city engineer of Brighton, England, which is built wholly on chalk, states, for example, that this material is sufficient foundation ordinarily, for macadam pavements, but in hard winters, if the layer of macadam is not thick enough, the frost will lift the surface of the chalk and mix it with the macadam and destroy the road. Good judgment must therefore be shown in discarding concrete. In some localities the condition of subsoil and direction of drainage is such that great care must be taken in draining the subsoil, and sometimes subsoil drains are necessary under the pavement or along the curb. In most cases, however, the expense of these drains is unnecessary. A macadam pavement in sound condition may often be used as a foundation for a permanent pavement, even asphalt, if the crown is not too great and the additional thickness of the new material will not set the wearing surface too high. The higher crown of gravel and macadam streets and the tendency to build them up faster than they wear away makes it difficult usually to fit the new pavement successfully to the ground, and if much material is taken up the well compacted layer is removed and the removal of more material and the construction of a new foundation is necessary. New foundations are necessary under all the new streets of the city of Indianapolis for these reasons, though, so far as solidity is concerned, many of the street surfaces could be used as foundations for new pavements.

Materials for Pavements About London. Mr. J. W. Parry has gathered information about pavements in the vicinity of London of which the following is a part, translated into American units:

Macadam costs $1.25 a square yard laid six inches deep; lasts one-half to one year and the annual cost for cleaning, sinking fund, interest and maintenance is $1.16 a square yard.

Granite sets cost $4.37 a square yard, three to four inches deep; last fifteen to twenty years, and the annual cost for items mentioned is twenty-nine cents.

Wood costs $3.50 a square yard, five inches deep; lasts eight to ten years, and the annual cost is fifty-four cents.

Asphalt costs $3.50 a square yards, two and two-fifths inches deep; lasts seventeen years and the annual cost is twenty-nine cents.

The steepest gradients used are 7 per cent. for macadam, 6.6 per cent. for granite, 2.2 per cent. for wood and 1.7 per cent. for asphalt.

All but the macadam are presumably laid on the same concrete base of six to nine inches depth, according to the English method. The prices for original construction are not materially higher than those common in this country. The annual cost per square yard is an excellent measure of the relative economy of the different pavements, including, as it does, the cost of cleaning, interest on first cost, cost of maintenance and a sum sufficient to replace the pavement when it is worn out.

Road Maintenance. Harold Parker gives the methods of maintaining the roads of Lancaster, Mass., in the journal of the Massachusetts Highway Association. The main road of the town is lined with houses and the roadbed is carefully prepared to a fixed grade and a crown of 1 inch in 2.5 feet. Stones four to five inches thick are placed on this, smaller stones on top of these and screened small stones on the top. The roadway is then rolled, covered with a thin layer of gravel, sprinkled and rolled again. The full depth is not stated, but seems to be nearly or quite twelve inches. The cost is given as thirty to thirty-five cents a square yard. Less traveled roads are covered with the best gravel within reach, the large stones being picked out and put in the bottom of the layer of gravel. A road machine or scraper is used in repairing these roads and the most unfrequented roads. Most of the attention given these latter roads is in the way of labor. There are nearly one hundred miles of roads in the town and the annual expense for repairs is about $10,000 and is sufficient to keep them all in repair when once made good. Nearly all the roads have now been improved as described and the annual cost of maintenance has been reduced materially.

The methods given by Mr. Parker are improvements over the methods in use in states where the road tax is "worked out" by the tax-payers, and the methods of repair especially are improvements, but there can be considerable advance made yet in the treatment of this question. The road machine, road roller and intelligent supervision are three essentials to thorough and economical road maintenance, and when to these is added a wise policy in the matter of new construction and protection of roads from wash and in location and construction of bridges and culverts, the roads will rapidly improve, demonstrating, as the roads in Lancaster do in part, that good roads are cheaper to keep in repair than poor and that they are economical of horse flesh and vehicles.

Highway Bridges. Carl Gayler, in a paper before the St. Louis Engineers' Club, printed in the Journal of the Association of Engineer-

ing Societies, states some of the points in which the ordinary highway bridge, constructed without expert assistance is defective. They include not merely the design and distribution of material in the superstructure, but the nature of the foundation, the form, dimensions and location of the piers and abutments, the length of span, area of waterway, action of stream and so forth. A few years ago there was considerable agitation of the subject of state control of highway bridges, which was restricted to the design of the superstructure. In the few states in which the discussion had any effect on legislation the duties of the supervising engineer were practically restricted to revision of the strain sheets of the designs, there being no inspection of the other features of the design, of the location of the bridge, or of the completed structure. Mr. Gayler rightly contends that the question of sub-foundations in the alluvial bottoms of most of our western streams is of the utmost importance, as well as the questions of amount and manner of restriction of the waterway and the shifting of the water-course. The details of floors and connections of floor system with trusses are also too often neglected, as well as the top wind bracing. Nor is the work of the engineer done when the bridge is completed. Intelligent supervision of painting and repairs often saves the construction of a new bridge on account of the deterioration of the superstructure, the washing out of the foundation or approaches by floods and other causes of disturbance. Objection has been made to the state control of design and construction on the ground that the counties originate the work, pay for it and must maintain it.

It is a fact, however, that the usual county official is not competent to decide upon the points of difficulty in a bridge design, and has not knowledge enough of the difficulties or of the lack of economy of the present unscientific way of doing the business. He seldom calls for expert assistance and then ignorantly calls upon the most available, whether competent or not, or upon some one interested in the sale of particular goods. The function of the state in its supervision would be largely one of education, in that bridges could not be constructed without conforming to well considered requirements, which should include those special features peculiar to the particular bridge, location, foundation and construction, as well as design of superstructure. The result would be economy in the maintenance of bridges, though the first cost would be greater, and year by year a greater saving of expense to the county. More bridges are destroyed by the failure of foundations than by the breaking of parts of the superstructure, and supervision of the entire design and construction is therefore desirable and would result in the greatest saving to the county. Bridge companies

now furnish superstructures with facility which conform to all requirements at reasonable cost, but the original design, including in this term the location, width of waterway, position of supports, character and construction of same, protection of wings, approaches, etc., is still given over to incompetent hands or permitted to make itself on the most convenient, cheapest or most expeditious lines at the time of the replacement of a destroyed structure.

Slow Sand Filtration of Water.

Mrs. Percy Frankland, the wife and the able assistant of the noted English authority on pollution of water, in an article in a recent number of *Engineering News* reviews the results obtained from slow sand filtration of water. She states that clean filters do not do satisfactory work in the removal of bacteria from the water, the reduction in numbers being only partial. In one case a flood increased the number of bacteria from 5,000 to 30,000 per cubic centimeter in the water running to the filters of one portion of the London supply. All but two of the filters had just been cleaned. In the effluent from the clean filters there were from 500 to 1,200 bacteria per cubic centimeter while in the effluent from the uncleaned filters there were from 90 to 100. Other experiments on filters after a few days use show that an increase in bacteria in the unfiltered water from 4,000 to 29,000 caused no increase in the number (66 to 86) of bacteria in the filtered water. Numerous examples of various conditions are given and the conclusion is drawn that efficient sand filtration is a precaution of the highest order but is not infallible and does not make it any less incumbent upon the authorities to secure the purest source possible for a water supply without reference to the possibilities of purification.

It is clear from these statements that if there are disease-producing bacteria in a supply of water the filtration of the water by the most approved methods is not warranted to remove them all, and that too great confidence must not be placed in the safety of water thus treated which has been seriously polluted. It is fortunate that the production of disease is more closely dependent upon the condition of individuals than upon the presence of disease-producing bacteria, otherwise epidemics of zymotic diseases would be more frequent and more serious than they are at present. A false sense of security on account of the precautions taken with the water supply should not lead to the neglect of the proper precautions in other directions. The city of Indianapolis is now pushing the construction of a sand filter for its water supply for reasons based on incorrect data, as evidenced by the reports in the daily press, and will probably find that the filtration will not materially abate the troubles which would arise from the sudden discharge of straw-board mill refuse into the river in quan-

tities such as were poured into it last spring. Without doubt, however, the improved quality of the general supply will be worth all the new filter plant will cost.

Power for Irrigation and Water Supply From Wells.

In much of the sub-arid region not in the artesian belt water is abundant not far below the surface and the winds are quite constant and strong, so that a wind-mill of sufficient size will furnish water for irrigating a number of acres. An eight-foot mill with a small reservoir to tide over days of low wind velocity will easily irrigate five acres, and a twelve-foot mill will take care of ten acres, as a minimum, and with sufficiently steady wind will cover three or four times this area. The reservoir may be very cheaply constructed in embankment, and asphalt concrete may be used to make it water-tight. A small reservoir at Indio, Cal., eighty-eight feet by forty-eight feet by four feet was lined with asphalt concrete at a cost of $700. Fifteen per cent. of asphalt was used with eighty-five per cent. of gravel and sand, but five per cent. of asphalt is believed to be sufficient. The layer of concrete is three inches thick. Gasoline engines are now made so cheaply and their management is so simple that they could be used to fill out the deficiencies of wind mills where the winds are not so steady. For many small towns of the same regions a water supply for domestic uses could be furnished at reasonable cost by the same means. The gasoline engine is coming into use for this purpose, and the wind engine will follow where that power is sufficiently steady to be depended upon. The two together promise to be sure and economical for small plants, the cost for maintaining the wind-mill being only the item of repairs, and the gasoline engine being used only when the wind is not available.

Water Waste.

The supply of good water for the city of Albany, N. Y., is in ordinary years too small, and it is necessary to pump from the Hudson river to supply the deficiency. The intake from the river is in front of the city, and in such location that part of the sewage of the city flows by the intake on both ebb and flow of the tide in the river. The river water is also much polluted by the cities and villages along the banks, especially those within six or eight miles of Albany. Many plans have been made for securing additional supply from better sources, but they have all proved too expensive. This year the city has been able to stop the pumps for a week at a time. This is partly because of the increased rainfall, which has kept up the supply in Rensselaer reservoir. The introduction of 1,700 meters into the system has operated to reduce the consumption of water from 19,000,000 gallons to 15,000,000 gallons of water a day, and this has had a material effect in sustaining the water level in the reservoir. The average consumption of water

in the city largely increased on account of waste, and the meters have checked the waste as noted. The population of the city is about 100,000.

Formerly charges for water were made to every house on a street in which water pipes were laid at rates depending on the width of lot and house and number of stories. Under the new schedule the same rates are assessed, provided the consumption does not exceed 150 gallons a day for each person. When the meter shows excess over this amount it is charged at a meter rate. The landlords in the city are objecting to the compulsory introduction of the water meter, because the tenant wastes the water for which the landlord must pay. It would be easy for the landlords to reduce the rent by the usual charge for water and require the tenant to pay the water rent and thus become responsible for the waste, except in flats, where it would be necessary to put in meters for each consumer, as the charge for water is made according to width and height of house, without reference to number of families. The custom as to payment of water rents varies in different cities. In some the tenant pays, in some the landlord, and custom governs in case there is no definite contract. The property-owner is ultimately responsible for the payment of the water rent in many cities, especially when the city owns the system, as in Albany.

The rate of 150 gallons per person was probably fixed because that was the average consumption at one time, determined by dividing the total consumption by the number of inhabitants. If thus obtained, two important factors have been neglected. Water used for manufacturing purposes, for water motors, hydraulic elevators and the like, should be deducted to determine the use of water for domestic purposes, as such uses can hardly be denominated waste, and consume large quantities of water for each such tap. If the city is not entirely supplied with water, the population not supplied should be deducted. The actual use of water per capita would then be determined by dividing the use for domestic purposes by the population actually served. If but little water is used for the purposes mentioned, and the city is fully served, as is supposed to be the case in Albany, the rate would not be far wrong, but it is conceivable that a rate so obtained would be too small for legitimate household uses. It is evident that 150 gallons per capita per diem makes a large allowance for waste in addition to legitimate uses, but in Leicester, (Eng.), for example, the attempt is made to reduce the consumption to 11 gallons per capita per diem, on account of deficiency in supply. Whether this is a starvation allowance, or is sufficient, without waste, depends upon the items mentioned.

Disposal of Refuse from Garbage Destructors.

Several English towns use the clinker which is produced in the furnaces in which garbage is burned, to make cement sidewalk flags, the clinker being crushed and mixed with cement in the proportions of one to three of clinker and compressed in a specially designed machine. The only objections seem to come from ignorance or carelessness of men in laying and finishing. The fine ash is used in some places for fertilizer. About the furnaces of our larger cities such uses of the ash may be made, but it can usually be disposed of for filling with quite as much advantage.

Sewage Disposal at Jamestown, New York.

Two of the officials of the city of Jamestown, N. Y., have made a tour of investigation of some of the various sewage disposal works in this country, and, to judge by their report, are not satisfied that the problem has yet been solved. None of the results seen have proved entirely satisfactory and the expense of the best methods seems almost, if not quite, prohibitory. They found various methods of cremation, filtration, precipitation, dessication, etc., in use, but in each instance the effluent was only clarified, but never purified. Again, smaller communities are debarred from the adoption of any process, they think, by reason of their great cost. They found the city of Worcester using a precipitation method, the cost of the plant being $200,000 so far, with additions costing $100,000 shortly to be made, an annual expense of $30,000 and a proposed expenditure of nearly $1,000,000 to separate the sewage from other drainage, all for a population of about 100,000. East Orange, N. J., is reported to have abandoned its precipitation system as entirely unsatisfactory after several years' trial. Brockton, South Framingham and Natick, Mass., Summit, N. J., and Wayne, Pa., which filter their sewage through land, were visited and fairly satisfactory results were observed. Three patented systems were visited which are still in the experimental stage, the plants being still in the hands of the contractors. Results vary in these plants.

Jamestown has a separate system of sewers which discharges the house sewage into a small stream at a point where nuisance is created on account of the small flow and the presence of dams. This result was predicted by a representative of the State Board of Health who visited the place before the construction of the sewerage system. The storm water finds its way into the same stream over the surface and through short drains. There are three methods of disposal possible, one to carry the sewage far enough down stream to prevent nuisance to any one; another to put in a system of chemical precipitation, patented or free; another to put in a system of filtration, artificial or natural. Some

combination of these would possibly be less expensive in first cost or for maintenance than any one alone. Perhaps the difficulty with the writers of the report is that they desire to make drinking water of the effluent, and are appalled at the expense, when a less perfect purification, at vastly less cost, would be sufficient for the case.

Indianapolis Telephone Franchises.

The city of Indianapolis has recently made a new contract with the Central Union Telephone Company whereby the company agrees to put all its wires underground within the central mile square, and places the location and number of poles outside this district under the control of the board of public works. The underground work is to be done on plans approved by the board and under their inspectors, and the company is to refund to the city the cost of inspection. Other companies may use the same conduits upon payment of a proportionate share of the expenses, the city engineer to be arbitrator in case the two companies can not agree. The city is to have the use of one duct in the conduits and of the top cross-arm of all poles for its fire and police telegraph systems, without charge. The city will have no other free service, but will receive $6,000 a year from the company, estimated to be equivalent to five per cent. on the gross receipts. The company agrees to give the best service, to put in the newest appliances and to have the work completed by September 1, 1897. There is no schedule of rates, but it is provided that the company shall not charge more for its service than it charges for similar service in other cities of the same size. The company relinquishes its rights and claims to a perpetual charter.

A contract has been signed by the board of public works and the Phœnix Telephone Company, and is now under consideration by the city council which is similar in its terms. In addition the period of its charter is fixed at thirty years and all rights or claims to further extension without direct contract are waived. This provision is in view of the fact that the Central Union Telephone Company, having operated under a former charter not having such a clause claims a perpetual charter, though it admits the rights of the city to regulation of the system. The Phœnix Company agrees to pay $1,000 to the city for the year 1900 and to increase the annual payment by $1,000 each year until 1905 when it will amount to $6,000 and will continue at that sum. The payments at first are less than for the Central Union Company because that company has been in business for some years and the Phœnix Company as yet has no business. The company agrees that business telephones shall cost not more than $42 and residence telephones $30 a year within two miles of the exchange and $6 for each mile beyond that distance. These rates are about half those of the present

company. The city will pay $18 for business telephones and $15 for police and fire alarm exchange telephones. All underground work will be completed by December 1, 1896. The company forfeits its charter and bond if not ready with an exchange and service for two thousand subscribers in one year.

It is believed that the city officials have made excellent contracts for the telephone service, as they have carefully guarded the rights of the city at all points, have provided for competition under such conditions as to make it advantageous rather than injurious, so far as that is possible, and has secured to the city a small revenue. The contract with the Phœnix Company differs only in detail from one presented a year and a half ago when that company first proposed to enter the city. The contract under which the Central Union Telephone Company has been operating expired some time ago and a contract fixing rates and similar in all respects to the Phœnix Company's contract was proposed, but has been modified as above stated.

For purposes of comparison, the Dundee (Eng.) Corporation owns the underground conduits and charges $1 per annum for each subscriber to the central exchange, $2.50 per annum for each large and $1.25 for each small junction box. For 3,000 subscribers this would be somewhat less than the revenue provided for in Indianapolis where the company owns the conduits.

Engineers For Small Cities. The appointment and tenure of office of the engineers of small cities, towns and villages are now usually very unsatisfactorily managed. The technical knowledge required is considerable and is seldom found among the land surveyors and draughtsmen that are the only available local timber. The office is too generally placed in the list with the political offices to be filled by workers for the party coming into power. A resident must therefore be appointed, and he is ousted and another appointed with each change in the city government, especially if there is a change in its political complexion. Two facts prevent young engineers from trying to secure such positions, one the short tenure of office, and the other the requirement of residence. As a consequence, in the great majority of small places, the engineering work is in incompetent hands, and the corporation is badly served at high cost, for the mistakes made are expensive and the condition of the streets and drainage show the futility of much of the work done. In many places the city engineer acts simply as a surveyor to carry out the orders of a council committee which is the true engineer. A rational view of the case in the light of sufficient knowledge would show that to secure the best results and true economy the engineer should be chosen for his abilities as an engineer, and not for the political ability of himself or his friends, that the competent man

should be selected without reference to residence, that he should be continued in office during good behavior and that the salary should be commensurate with the ability required and the work to be done. The English method is a vast improvement over our lack of system. When a vacancy occurs in the office of surveyor or engineer, or assistant, the fact is advertised and the best available candidate is selected, frequently after an examination. Thus men are encouraged to enter the field of municipal engineering, as there is opportunity for rise in position and in salary as their abilities and experience permit, without restriction to the small field of a single small corporation. Another good feature is the appointment at a salary which increases annually until a maximum is reached in from three to five years. Engineers often remain for long periods of time; for example, the engineer of Hamilton, Ont., has recently died after a term of service of forty years. The adoption of such a system of appointment and continuance in office would act to improve the condition of affairs in many ways. The engineering work of the corporation would be given over to the competent authority, instead of being done by council committees; men without technical knowledge or special capacity, in the intervals of their private business. Politics would have a minimum effect on the conduct of public work. Public confidence in the utility and economy of proposed public work would be gained.

The Sewerage of Sacramento. The city of Sacramento lies largely on low land, some of which is below high water level in the river, and its outlet sewers must be below the level of the river. The entire discharge must therefore be pumped over the levee into the river. The outlet sewer will be six feet in diameter, and will carry off a rainfall of one inch in 24 hours, or about 3,000,000 gallons an hour. In the bottom of the sewer it is proposed to place a channel 24 inches in diameter, made of the half of a 24-inch pipe to carry the ordinary flow of sewage. Flush tanks are to be put at the end of each branch to keep the pipe lines clean in the dry season. These flush tanks will discharge from 250 to 300 gallons each twice a day, alltogether using about 250,000 gallons a day. The water consumed by the city amounts to 4,000,000 to 6,000,000 gallons a day. Where the entire discharge must be pumped, as in this case, it is evidently essential that the amount of sewage be reduced to the lowest possible figure. The population of the city is about 27,000. The amount of storm water provided for in the outlet or intercepting sewer is therefore about five times the present amount of sewage discharge, assuming that all the water supplied flows off through the sewers. The rainfall of Sacramento is not large, but will frequently be

more than one twenty-fourth inch an hour. The excess must be discharged directly into the river from the areas above high water. It would seem to be the proper procedure to design the outlet to take all the storm water from the low ground, and none from the higher ground.

Government Testing Laboratories.

Two or three bills have been introduced in the present congress providing for engineering experiment stations in connection with colleges established under the agricultural college act of 1862. Most of the work proposed to be done by these laboratories could be done much better and with less expense, if done in one laboratory under competent direction. The money necessary to run the one laboratory would be much less than the $1,000,000 or more a year which it is proposed to appropriate for these laboratories; competent direction for the single laboratory would be more readily obtained than for the many scattered laboratories removed from close contact and control of a central authority; and the investigations entered upon would ordinarily be more thoroughly, rapidly and economically carried through.

Much of the commercial testing work of the stations would be better done at a single central laboratory, but two or three branches of this work, such as cement testing, and brick and stone testing, require proximity of the laboratory to the place where the work is being done. This class of work, if well done, should be almost self-supporting under a schedule of small fees, but until confidence in methods and results is secured would require that deficiencies be made up. Such small laboratories could be established at the land grant colleges, but would then have the disadvantage of lack of direction by a central authority, which is extremely desirable on account of the many methods of testing cements and brick in vogue, the lack of any authoritative system and the influence of "personal equation" on the results. The government usually has much construction work in progress in all parts of the country on which large quantities of these materials are used, and needs the information obtained from the tests. Several cement testing plants are now in use on the larger works. If these plants were under a central authority, and thus constrained to use common methods, and especially if the operators had a common source of instruction, and were authorized and required to do commercial testing for all applicants under a proper and low schedule of fees, uniform and comparable results might be expected and the work would be of the greatest value to public work of all kinds. Additional laboratories to those now in use would probably be necessary. The government work being under several departments which are independent of each other, the laboratories should be placed in charge of some

one department and other departments authorized to call on them for tests.

Electrolysis of Water Pipes. Kansas City and Detroit are discussing the question of the action of the electric currents of street railway lines on water pipes. In Kansas City the question is becoming quite serious, and Professor L. I. Blake has recently made a report to the water board attributing the pitting of water pipes and their ultimate destruction to the defective bonding of the rails which should act as the return conductor. When the current can not all return to the dynamo at the power house through the conductors provided for it, the nearest good conductor is utilized. This is probably a water pipe. Where the current enters the pipe there is no action upon it, but at the nearest point to the dynamo at the power house, the current must leave the main and go to the dynamo through the ground. At this point the electrolytic action is serious. The remedies are to improve the bonding of the rails so that the current can all get back through them, and to connect the water pipes, at the points where electrolysis is observed, by adequate metallic conductors to the dynamo. This latter remedy requires careful examination of the pipes at all suspected points and complete metallic connection with the return circuit of the railroad. Many cities, among them Brooklyn, Providence, Detroit, St. Louis, St. Paul, Milwaukee, Cincinnati and Chicago have experienced the same trouble. Its source is now quite well understood, and the remedy is not very difficult of application. Judge Davidson, of Montreal, is reported to have ruled recently that the street railway company has a right to use the earth for return circuit, and dismissed the action for $27,000 instituted by the Bell Telephone Company, after much expert evidence had been heard. It is not stated whether the matter of electrolysis of conduits was included in this particular case or not. The right to use the earth for a return circuit, if unrestricted, will, however, affect the rights of every company or corporation having water or gas pipes or conduits underground, in addition to the effect upon currents in other electrical circuits. The general opinion seems to be that the electric current of street car lines is the later occupant, and the company using it must take care that its use does not injure prior occupants or those doing no injury to any one else by their systems of pipes or conduits.

Creosoted Block Pavements. The city of Indianapolis has determined upon a trial of creosoted long leaf yellow pine for pavements, the blocks to be rectangular, four or five inches deep and laid close together. The blocks are to be treated by first subjecting them to steam at a temperature of 300° F. in a vacuum for two or three hours, and then subjecting them to a pressure in a tank

of creosote oil, which will saturate the blocks with oil, twelve pounds of oil to be used for each cubic foot of timber. The Washington redwood blocks which are now being laid on two streets are saturated to the depth of an inch, but the oil impregnates the block more or less, throughout. The material used is the dead oil of coal tar, which contains tar acid. The reported formation of naphthalene on the outside of the blocks indicates this. Asphalt is said to be seriously affected by the chemical action of the creosote, and there is complaint also of its destruction of rubber tires of carriages and bicycles. City Engineer Jeup has undertaken experiments to test its chemical effect in this respect. Probably the only objection to using the coal tar product rather than the wood product, is that the coal tar product is more volatile, and from twelve to thirty per cent. more material should be used to obtain the same permanent result, or, say twelve pounds should be used per cubic foot of blocks where ten pounds of wood creosote would suffice.

The latest results of careful observation of wood block pavements are given in a paper by Arthur E. Collins, city engineer of Norwich, Eng., in which he states that creosoted deal has lasted eight years and with slight repairs will last four years longer, and that it costs 20 cents a yard a year for maintenance, the first cost being $2 a square yard. The sub-foundation is gravel and chalk, so that concrete foundations are found to be unnecessary if the wearing surface is well laid. Uncreosoted deal blocks become rough after about seven years, and must be renewed during the eighth or ninth year. Creosoted deal is in good order after eight years, except roughness on 3 per cent. gradients. Creosoted pitch pine was not successful, the heart wood wearing better than the surrounding rings, although all sap wood was carefully removed. Cement filling was used between blocks with great success. Tar filling gave trouble in hot weather on account of the chemical action of the creosote on the tar. The traffic in Norwich is close and continuous, and more concentrated than usual, the streets being narrow and winding, and there are not many heavy loads. Many other similar results indicate that the life of a block pavement may be extended about fifty per cent. or from about eight years to twelve years by creosoting. The first cost on proper concrete and well laid is greater than for asphalt, the maintenance charge is greater, and the durability is less. Wood pavement, well kept up, has some advantages, and if property-owners are willing to pay the extra expense and are willing to put up with its disagreeable features, no one else can seriously object, but if the expense of maintenance must be borne by the city, quite a serious burden is imposed upon the street repair fund. Most reports of cost of street repairs indicate that the maintenance of wood pavements costs from

50 to 100 per cent. more than asphalt if the same condition of wearing surface is maintained, and if the additional cost of replacing is taken into consideration not less than twice as much. The first cost of first rate wood pavement is higher than that of asphalt, in some cases as much as fifteen or twenty per cent.

Plats for Additions to Cities

One of the most unsightly things in the appearance of cities is the great variety of street widths, and the lack of uniformity and of conformity in the location of streets as laid out through various additions. Scarcely any of the cities in the country have paid any attention to this matter until too late for action. As a consequence even the youngest cities whose original plats are models of what city plats should be, are often the most irregular when their rapid growth has caused many additions to be made by various owners of adjacent land. Each owner has platted his addition according to his own ideas of such matters, probably to secure the greatest possible number of lots out of his particular piece of ground without reference to the ground of his neighbors or the streets of the contiguous city plat. Various widths and depths of lots, widths of streets and alleys, and directions of face of lots, made independently, cause narrowing and widening of streets without plan, jogs without number, even streets without outlet, streets with only one side available for frontage and many other troubles. A favorite trick for property-owners to play, to retaliate upon owners of adjacent property for wrongs done or fancied, is to lay out a street or a half street leaving two feet between the street and the property line. This sometimes reacts upon the one making the plat, when he is forced to pay for the pavement in front of his lot of only two feet depth. Such silly procedures as well as all failures to take proper account of surrounding plats and future possibilities can easily be stopped by a proper ordinance, or charter provision, if necessary, providing that no plats can be legally filed for record as a basis of sales until they are approved by the proper city authority, which should be the city engineer and board of public works. Even then there are sometimes persons so determined that their method is the only right one, that they will sell property by metes and bounds rather than plat according to requirements. Fortunately such lots can only be sold easily along existing streets and their influence does not extend very far.

Vulcanite Paving in Pittsburg.

In 1892 the department of Public Works of Pittsburg adopted a vulcanite specification calling for six inches of broken stone, a bituminous binder of one and one-half inches and a vulcanite wearing surface of one and one-half inches. The vulcanite paving cement is about one-third asphalt and two-thirds coal tar. Booth &

Flinn have received prices for vulcanite pavements varying from $2.90 a square yard to $2.50 in 1895. The Pennsylvania Asphalt Company entered into competition in May, 1896, with Bermudez asphalt and caused the price for vulcanite to drop to $1.85. However, the Pennsylvania Company was not admitted, as the specifications called for Trinidad lake asphalt or vulcanite. In August the Pennsylvania Company bid on Trinidad lake asphalt. Eighteen of twenty streets laid this year have been laid with vulcanite, and only two with Trinidad lake asphalt.

Experience in Pittsburg and in other cities has shown that the broken stone base, without hydraulic cement, is not sufficient to produce a stable pavement unless the sub-foundation is exceptionally solid, unequal settlement being quite certain to occur. The coal tar wearing surface, when in perfect condition, is perhaps the most acceptable surface to travel over of any pavement, but the material is so soft that it wears rapidly and requires very frequent repairs to keep it in condition. The early coal tar pavements were quite successful when laid by expert workmen, but the very men who laid good coal tar pavements years ago will declare their inability to do so now owing to the fact that the modern development of the manipulation of coal tar has given us so many new and valuable products that the coal tar of the present day is quite different from and much inferior to the coal tar of twenty or thirty years ago. When good asphalt pavements can be obtained for the low prices offered in Pittsburg this year, it is strange that the authorities will lay pavements of a material so much inferior and less expensive at prices so nearly the same. Any slight difference in first cost in favor of vulcanite will be much more than made up in the course of the first year or two of repairs by the city on account of the superior durability of asphalt.

CURRENT INFORMATION.

ST. PAUL WATER WORKS.

The St. Paul water works are managed by a Board of Water Commissioners appointed every four years by the Mayor. They were first built by a private corporation and put in operation in 1869. The city purchased the water works in 1881. The supply is from a chain of nineteen lakes, at least nine of which are available for the city's supply. These lakes have a combined area of 2,436 acres, and from one to four feet can be drawn from them. Some artesian wells were driven in 1890, and this supply cools the water from the lakes and improves its quality. Last year a 30-inch conduit was built from Pleasant lake to Otter lake, making available 500,000 gallons additional storage. The business portion of the city is supplied by gravity, and such portions as are less than 150 feet above the Mississippi river level. The remainder of the city, using a little more than half the supply, must be served by pumping to the high service reservoir, which is 310 feet above the river. The reservoir has 16,000,000 gallons capacity, and the pumping capacity is 12,000,000 gallons a day. A small high service section on the west side is served by a 1,000,000-gallon pumping engine pumping a few hours a day into a tank at an elevation of 343 feet. Under a large portion of the business part of the city the water pipes are laid in tunnels in the soft sandstone, and are thus easily inspected, tapped and renewed without cutting into the streets. The total cost of the water works to date has been $3,584,417.52, of which $1,124,417,52 has been paid from the revenue of the works, and $314,615.70 are now in the sinking fund to pay bonds on maturity. In addition to this excellent showing the water rates have been reduced more than half since the city obtained control. There are but few meters in use. Prior to 1891 amounts sometimes as high as $140,000 a year, or 40 per cent. of the revenue, were raised by taxation for fire purposes and to make up deficits.

SEWAGE DISPOSAL AT ALLIANCE, O.

Alliance, O., is a city of 8,000 to 10,000 people, on the Mahoning river. The city has just completed a plant for the purification of its sewage by chemical precipitation. The plant is similar to that at Canton, O., and has been constructed by the city engineer, O. W. Pfouts, who built the former works, with L. E. Chapin as consulting engineer, who was the engineer in charge of the design and construction at Canton. Lime and sulphate of alumina are added to the sewage in a flume, and the fluid then flows through a series of tanks 80 feet by 40 feet by 6 feet, in which the solid matters settle, the clear liquid flowing off into the river. The sludge is run into a Bonnet sludge press of 50 chambers, under a pressure of 80 pounds to the square inch, and comes out of the press in cakes about 28 inches in diameter and 2 inches thick. These cakes are dumped about 300 feet from the building and are hauled away to serve as fertilizer. The main building is 30x36 feet, the boiler-room 20x32 feet and the stack 80 feet high. The engine is a 12-horse power engine, and runs the mixing machinery and the sludge press. Figures for the cost of maintenance cannot yet be given.

ANNUAL MEETING OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The third annual meeting of the American Society of Municipal Improvements will be held in Chicago, Oct, 14, 15 and 16. A letter from President Benzenberg states that no local arrangements at Chicago have yet been made, and Mr. Kerr, the second vice-president, who represents Chicago officially in the organization, says that the local committee has not yet been appointed, but will be soon. Secretary Fulton will issue his first circular calling attention to the meeting at an early day, and it is expected that the Chicago local committee will have the arrangements well under way by the latter part of this month. President Benzenberg has been in correspondence with the different committees, and says that they are all at work. Their reports will be the most important feature of the meeting, together with the discussion and the papers on the various subjects.

PUBLIC WORK IN NEW HAVEN.

During 1895 the Board of Public Works constructed 5,032 miles of new sewer at a cost of $87,783.84. There are now 84.389 miles of sewers in use in the city. A 54-inch brick sewer, with pile and timber foundation, cost $15.50 a foot; 30-inch brick sewer, with 8-inch invert and 4-inch arch, cost $3.10; 24-inch brick sewer, same construction, cost $3.04; 18-inch pipe sewer cost $1.52; 15-inch pipe, $1.13; 12-inch pipe, 98 cents per foot; 130 catch basins were built, making the total in the city 1,623, and 286 receivers. Cleaning and repairs of sewers and drainage cost $17,564.19; 2,547 catch basins were cleaned at a cost of $1.40 each time. The cost of flushing pipe sewers was $839, and of cleaning brick sewers was $1,056, a total of $1,895, over $22 a mile. If we assume two flush tanks per mile of sewer, each using 500 gallons a day, and that the city pays 3 cents a 1,000 gallons for the water used, the annual cost for maintenance of flush tanks would be $919.80. Water for flushing is not paid for at present. If it were the cost of flushing would be materially increased. The use of flush tanks would reduce the above expenditure for flushing pipe sewers to almost zero, and would reduce the cost of cleaning brick sewers. There is thus not much difference in the cost of maintenance of the two systems in this case, but the service by flush tanks would be more continuous and so far better. The minimum charge in the water company's schedule is 10 cents a 1,000 gallons, but for the quantity of water used in the flush tanks a more favorable rate should be obtained, as meters are not necessary, an occasional test being sufficient to keep the consumption of water in control. Pavements aggregate 40.225 miles, of which 34.741 are telford or macadam, 4.378 stone blocks, 0.129 cobblestone, 0.343 brick, 0.408 coal tar and 0.226 various kinds of asphalt. The average width of pavements is 30 feet. There seems to have been no new construction during the year, the work being restricted to "hardening" several streets with cobblestones and broken stones. A new stone crusher was purchased and the city owns a road roller.

It is somewhat difficult to distinguish the work belonging to various departments, but as nearly as can be ascertained from the report the city spent $215,000 for public works, including repairs, maintenance, salaries and new construction. The cost of supervising this work was 8.5 per cent. The supervision of the street department seems to have cost about 12 per cent., and the work apparently under the supervision of the city engineer's department was constructed at a cost of nearly 10 per cent., for supervision, the salary list and contingent expenses of that department aggregating nearly $11,000 and the street department and parks not being included. The city government of New Haven took great interest in the establishment of the Society of Municipal Improvements and has sent seven delegates to each of the meetings, who have taken much interest in the proceedings.

ASPHALT PAVING IN PITTSBURG.

Oliver McClintock, representing the Municipal League of Pittsburg, has been urging a modification of the specifications for asphalt paving in Pittsburg so as to admit the use of other asphalt "equally as good as that from Trinidad lake." It was contended that Booth & Flinn had exclusive use of Trinidad lake in Pittsburg, and that other companies there could not buy it. This was the claim made by the Pennsylvania Asphalt Company. At a recent contract letting, however, the Pennsylvania company submitted bids for the use of Trinidad lake asphalt. An official of the company said that they had found that they were mistaken in asserting that they could not get Trinidad lake. "Matters had reached such a crisis," he said, "that we concluded we ought to solicit Trinidad asphalt and find out whether we could get it before proceeding further along the line of our contention. Accordingly we started a correspondence and learned that they were willing to supply us with Trinidad at a figure practically as cheap as our own. They were satisfied that we could lay good pavements and in consequence would permit us to use Trinidad. People are aware, I presume, that skill is an important factor in putting down asphalt pavements. The Trinidad company figures that if an unskilled firm put down Trinidad pavements and the pavements did not wear all other firms would use this failure against the Trinidad company in all cities where there was competition. We solicited the Trinidad company to furnish their material. We have no time contract with them, but we are satisfied they will furnish it to us as long as we continue to put it down skillfully and scientifically."

Senator Flinn, of the firm of Booth & Flinn, in a discussion with Mr. McClin-

tock before the council committee on the modification of specifications, declared that any company that could build a proper plant and give a reliable guarantee that the material would be skillfully handled could buy Trinidal lake asphalt at as low a price as he could get it for.

REPORT ON PAVING IN SEVERAL CITIES.

The report of the special committee appointed to investigate street paving in other cities was submitted Aug. 3 at Binghampton, N. Y. In Olean the committee found that brick, on a concrete base, with a sand cushion, was used. The pavement did not show much wear. Its cost was $1.49 a square yard. In Dunkirk a brick pavement laid in 1891 was found to be badly cracked, and one street that has but little traffic was found in good condition. The rumbling noise of the pavement is objectionable to the residents. Some new brick pavement had just been laid in Buffalo at a cost of $2.45 a square yard. Asphalt block has been used in this city, but it was badly worn. City Engineer Guthrie of Buffalo is credited with believing that sheet asphalt is the best known pavement. A brick pavement on East avenue, Rochester, was found in good condition, but the residents of the street complain of the noise. The brick pavement in Poughkeepsie is of very poor quality. Its cost is $2.07½ a square yard. The asphalt block in use is $2.75 a square yard on a concrete base, and $2.50 a square yard on sand. It shows wear. In New York City the asphalt blocks on Eighty-fifth and Eighty-seventh streets showed much wear, although laid but two years. Sheet asphalt seems to be gaining favor in this city, especially for heavy traffic streets. Newark, N. J., laid 172,000 square yards of asphalt in 1895 and will lay 75,000 more this year. The noise of the brick pavements laid has caused much complaint. The street improvement assessments are of the "betterment" plan, and the property-owners of one street have refused to pay for the pavement, claiming it is a damage to their property. The case is now in the courts. Asphalt is the principal material used on heavy traffic streets and brick for suburban and cross streets in Philadelphia, Pa. The noise of the brick pavements is complained of in this city also, and when streets are repaired it is costly and the surface is rendered uneven. Philadelphia laid, in 1895, 630,000 square yards of asphalt. In the matter of dust all pavements were about equally objectionable. No matter what the pavement is, if not properly cleaned, the dust causes much complaint. The committee found that the cities using the block system of cleaning obtained the best results.

"This system consists of placing a man upon a block, or in some cities, three blocks, a man is employed during the day, removing the deposits with a broom to the curb, where they are immediately placed on a wheelbarrow and removed. This method avoids the unsightly piles of dirt, which are sure to be distributed by the wind. The broom also removes the fine particles of dirt. This appears to be much more satisfactory to those cities using this system than the use of the iron scraper. In addition to this method some of the cities where the asphalt pavement is kept beautifully clean flush the pavement by the use of fire hose, flushing the same two or three times a week, according to the necessity of the particular street. This work is done after 10 o'clock at night. This flushing removes from the surface of the pavement all the particles of dirt. The surface is comparatively without any objectionable features between the times of flushing. No sprinkling of those streets by sprinkling wagons is allowed during the day. This avoids the very universal complaint of wet and slippery pavements for bicycle riders or drivers of vehicles, the street during the day being dry and clean."

PITTSBURG'S OLDEST ASPHALT PAVEMENT.

In a recent argument over the merits of various paving materials William Flinn of Booth & Flinn said that "the best asphalt paving in Pittsburg or any other city is that on Forbes street, east of Craig street, which has been laid for 21 years, and is as good a sample of paving as any."

CARE OF UNPAVED STREETS IN PHILADELPHIA.

Chief Hicks of the Bureau of Highways, Philadelphia, sent a letter to each of the assistant commissioners, Aug. 11, requesting detailed reports of the condition of unpaved streets in the city, which are under contract to be kept in good repair. He says:

"Let me advise you against forwarding to this office any report that fails to give a direct, complete and comprehensive answer to each item of complaint. Let me repeat to you what I have already stated

on several occasions; the specifications are clear enough to be understood. They provide for the maintenance of unpaved and macadamized public highways, small bridges, drains and steps, including furnishing, delivering and spreading broken stone and screenings during certain months of the year. It is no excuse if a road is not in good condition to report that it has been practically abandoned, because if it has been practically abandoned by reason of not having been kept in repair assistants and inspectors are at fault for permitting it to get in such condition; nor is it satisfactory when a complaint is made and a deficiency pointed out to receive a report advising us that the complaints have been attende to, the needed repairs made, which of themselves are an admission that there was cause for complaint which should not have existed.

"I do not mean to imply that it is expected that all streets shall day in and day out all the year around be kept to the very highest state of perfection, such as is attained in the maintenance of magnificent park drives, where there is never any heavy traffic, and where about as much money is spent upon the maintenance of roads which traverse a few thousand acres of land as is allowed for the maintenance of over 500 miles of dirt and macadam roads maintained by this bureau; nor do I believe that any reasonable person would interpret the specifications to mean that such was expected, but we do expect that all work coming under this contract shall be properly and satisfactorily completed to the end that all dirt and macadam roads shall be kept in good and travelable condition."

SANITARY PROTECTION OF WATER SUPPLY IN NEW YORK.

The New York State Board of Health has established rules for the sanitary protection of the water supplies of New York, Brooklyn, Rochester, Watertown, Syracuse, Elmira, Mt. Vernon, Newburg, Norwich, Cobleskill, Ilion, Ft. Edward, Sing Sing, New Rochelle, Coxsackie and Skaneateles. Under the laws of New York the rules of the board at once take effect.

SINGLE COURSE BRICK PAVEMENTS.

In response to an inquiry regarding single course brick pavements from G. A. Bryan, Galesburg, Ill., T. S. McClanahan, city engineer at Monmouth, Ill., says:

"First, we have a single course pavement on a street of heavy traffic, brick laid on five inches of sand, after thorough rolling; curb 5x24x72 inch Berea sandstone; crown of curvature 8 inches in 30 feet width; would not use any less sized curb as this; the curb is the secret of the crown keeping its position. Ours has not settled in holes as much as two course work. I saw a 7,000-pound load pass over it yesterday and you could not find the track. It has been down since last October, and we claim it is a success. I am going to lay some more now in a short time. I claim the honor, if it is an honor, to have laid the first purely single course brick in the state."

PUBLIC SANITATION IN ILLINOIS.

The civil engineers and the physicians of Illinois met in the rooms of the Western Society of Engineers, Chicago, Aug. 5 and discussed how regulation of the health of the municipalities of the state could be made a legal necessity. A committee was appointed which will draft a bill, the purpose of which will be to give to some central body the power to regulate city water supplies and sewerage systems and the sanitation of public buildings. The bill will be presented to the legislature in January. The committee in whose hands the drafting of the bill is placed consists of the following: Dr. John A. Vincent, state board of health, Springfield; Dr. O. B. Will, Illinois State Medical Society, Peoria; Dr. A. W. Palmer, University of Illinois, Champaign, Ill.; Jacob A. Harman, Illinois Society of Engineers and Surveyors, Peoria; Dr. H. M. Bascom, Ottawa, and Dr. J. B. Dunham, Wenona State Homeopathic Society; Dr. R. G. Shafer, Morton, and Dr. Henry Wohgemuth, Springfield, State Electric Medical Society. The committee will meet again Sept. 2.

LICENSING OF PLUMBERS AND SEWER CONTRACTORS IN OHIO.

The new law passed during the last general assembly at Columbus, O., and providing for the appointment of a board of examiners whose duty it should be to ascertain the qualifications of persons engaged in the plumbing and sewer contracting business, with a view of eradicating the incompetent workmen from the craft and improving the character of plumbing and sewer work by placing the workmen engaged in both under a license system, became operative Aug. 1. The law provides that in cities of 5,000 or more inhabitants, having a water and sewer system, a board of examiners shall be appointed to consist of the president of the board of health, the inspector of

buildings, two master plumbers, and one journeyman plumber, but in case the town is without plumbers their places are to be filled by reputable physicians and provision is also made where the town does not have the office of building inspector.

Three months after the date upon which the law becomes in force, the board will appoint one or more inspectors of plumbing who shall be confirmed by the city council and their compensation fixed by the board of health. Three months later rules applying to the construction, alteration and inspection of sewerage and plumbing shall be formulated by the board of health and approved by council and permits shall first be obtained for all work of either character except in case of leaks. License may be revoked at any time at the discretion of the board, for incompetency, dereliction of duty, or other causes, after a full and fair hearing before the board. Provision is also made in the law for fines for violation.

A CONTRACTOR'S LOSS CAUSED BY AN OFFICIAL ERROR.

Suit was brought recently at Erie, Pa., to collect the assessment for the paving in front of half a square of property on the south side of Eighteenth street. In the first trial of the case a judgment was given against the defendant, Mary L. Moody. The case was carried to the supreme court, where the lower court was reversed with the order to go to trial again. In the second trial Judge Gunnison sustained a motion made by Attorney Force for a non-suit on the ground that by reason of the insufficiency of the controller's certificate on the back of the paving contract there was no contract in force at the time the pavement was laid by Henry Mayer, the contractor, and there could be no recovery. The plaintiff took a writ of error to the supreme court and the judgment of the lower court has been sustained, which will relieve the Moody property of an assessment of about $1,900 and the interest on the claim. The ruling made by Judge Gunnison was a surprise, as nearly all contracts similar to the Eighteenth street contract were approved. It is claimed that the contractor can now sue on account of a mistake by a city official.

PROPOSED ARBITRATION OF CLAIMS AGAINST CONTRACTORS.

The city of Columbus, O., claims that Henry S. Hallwood, Albert Adams, N. B. Abbott and the T. B. Townsend Brick and Contracting Company have been overpaid $40,000 on contracts for sewer construction, and suits against them are pending in both the civil and criminal courts. Trial of the case in the latter resulted in a disagreement of the jury. A proposition has now been submitted by the attorneys for the defendants for a settlement of the matter by arbitration, and this has been referred to the judiciary committee for consideration.

THE NEW EAST RIVER BRIDGE.

The plans for the new East river bridge, which have been officially adopted, provide for an entire steel structure, which will be 7,200 feet in length, the distance between centers of suspension towers 1,600 feet, length of open span across the East river 1,358 feet. The roadways will be supported by four enormous steel cables, each 17½ inches in diameter and consisting of 19 strands or smaller cables, composed of a multitude of wires. These cables will be stretched over the towers and anchored at each end in solid masonary at a distance of 500 feet from the towers. The four granite bases for the tall steel towers will be laid on caissons to be carried down to the bedrock by the compressed air system, and will stand with the outer edges on the pier-head lines. These bases will be twenty feet above high water mark. Each of the two pedestals will be 60x76 feet at the top, with a space of 56 feet between them. The towers will be 130x50 feet at their bases and will rise to a hight of 336 feet above high water, the sides gradually sloping upward until the tops will be 20 x210 feet. Each tower for receiving the cables will be surmounted by four solid saddles, each 20 feet long and 7 or 8 feet wide. The approaches will start on a 3 per cent. grade and will connect with the central span by vertical curves. These approaches will be supported by steel pillars and trusses of massive size, which stand on strong masonry bases. The width of the bridge is estimated at 118 feet, which will afford ample room for six railroad tracks and the necessary roadway for vehicles. Of the railroad tracks four will be used by trolley car trains for the transportation of passengers entering on foot at either end of the bridge, and the other two tracks are intended for the use of the elevated road trains, which can carry passengers to and from distant points in New York and Brooklyn without charging cars or meeting with any delay. The vehicle roadways will be 18

feet wide and will be located on the outside of the railroad tracks; the promenade for foot passengers will extend over the tracks, thus affording a clear view of the river at any point. The flooring will be wood, and all bridge trains will start from the level of the pavement and deliver passengers in the same way. The estimated cost of the bridge is between $5,000,000 and $6,000,000. The bridge was designed by Chief Engineer Lefferts L. Buck. The commission in charge of the work is Col. Andrew D. Baird, Salem H. Wales, F. B. Thurber, Richard Deeves, Henry Batterman and James H. Sperry, with Mayor William L. Strong and Mayor Frederick W. Wurster ex-officio members.

SHADE TREES AND ASPHALT PAVEMENTS.

The apprehension that has been expressed by Brooklyn residents regarding the effect which the laying of so much asphalt pavement would have on the growth of the shade trees along the streets will probably be somewhat allayed by a letter by Prof. Lewis Collins, secretary of the Tree Planting and Fountain Society, in which he says:

"Asphalt pavement is becoming quite common, and it is so great an improvement over other pavements that people will look with a great deal of interest to whatever of injurious influence it may have. It is easy to conclude that this pavement will be injurious to trees. We have had asphalt pavement a number of years, and trees flourish along such streets quite as well as elsewhere. The soil of Brooklyn, and we may conclude much of Long Island, is especially well adapted to the growth of trees under pavements. The earth is mostly a sandy loam and gravel beds, below which, at varying depths from the surface, owing to the undulating condition of the surface, there is an inexhaustible supply of water. The moisture rising from this subterranean lake keeps the ground above well moistened and in a condition suitable for tree growth. Pavements, and especially asphalt pavements, prevent the moisture from passing from the ground to the air in the form of vapor. That is the reason that the earth flagging or pavement of any kind impervious to water or vapor is moist in Brooklyn or any place with similar conditions beneath the surface, no mater how severe a drought may be. Indeed, it is quite probable that here in Brooklyn we may find asphalt pavement a benefit to tree growth."

INVESTIGATION OF PUBLIC WORK IN PHILADELPHIA.

An investigation into the management of the bureau of surveys was recently begun at Philadelphia by the Senate Investigating Committee. Much testimony was given which revealed the extent to which specifications in sewer building were ignored by certain contractors, and how inspectors, employed to see that the work is properly done, neglect their duties and permit the contractors to do as they please. Investigation disclosed the fact that much defective work had been accepted by the city. In one instance a sewer that should have been 4 feet 6 inches in diameter, was contracted in the center to 3 feet 4 inches, so that water would not run out. Where branch sewers of 2 feet 3 inches were to be constructed, 15-inch pipes were laid. One contractor used ordinary cement where the specifications called for Portland cement, but had a barrel of Portland cement on hand to exhibit to the inspector. One sewer was laid so deep in water, one workman testified, that he "had to feel with his hands where to place the bricks." Two samples of cement taken from the sewers were produced by one witness, which crumbled in his hands like a cracker. Street paving affairs were also taken up by the committee, in which much cause for complaint was shown. The investigation will, in all probability, result in a great deal of reform work, not only with the inspectors and other responsible parties in the employ of the city, but with contractors in their methods of construction.

WATER PURIFICATION EXPERIMENTS AT LOUISVILLE.

The experiments in purification of water at Louisville, conducted under direction of Charles Hermany, chief engineer of the water works, have been completed and the report is now being prepared. A letter from Mr. Hermany says that "the scope of the investigation was so extended as to make the proper collection of the results a work of considerable magnitude," and it will probably be some time before they will be made public. The experiments were begun in October, 1895. A capacity of 250,000 gallons a day was provided for in each of the four patented processes which were tried, and the plant for each system was operated by the company controlling it, the city delivering the water without charge to the companies. The chemist and bacteriologist in charge was Mr. George W. Fuller. The companies which provided experimental plants were the Western Filter Company, the O. H. Jewel Filter Company, the Cumberland Manufacturing Company and the John T. Harris Magneto-Electric Purifying Company.

ASPHALT RESURFACING IN OMAHA.

Omaha recently advertised for bids for repairs of asphalt streets under a specification calling for bids per square yard per year for the entire pavement, per square yard of asphalt actually laid and per cubic yard of asphalt acutally used, for periods of five years and ten years. The specifications were such that the surface heaters could not be used. Under the first specification the bids ran from 5 to 9 cents a yard per year, and under the second from 95 cents to $1.10 a yard, there being little difference between the bids for five-year and ten-year periods. John Grant received the contract for most of the streets laid with Trinidad lake asphalt at 98 cents per square yard actually laid, for a five-year period. A suit for injunction was brought to prevent the mayor signing the contract on the ground that the specifications had not been properly prepared by the board of public works and were not approved by the city engineer as required by law.

RAINFALL AND MUNICIPAL RESPONSIBILITY.

If a city constructs its sewers improperly and as a consequence damage results to the citizen, the city is responsible. The only question in each individual case is as to the fitness of the sewer, in design and construction, for its duty. This duty is a two-fold one; first, the sewer must carry off ordinary sludge without due accumulation and fermentation, and, second, it must be adequate to the demands of a reasonable amount of rainfall without backing up and overflowing property. This reasonable amount of rainfall has reference to time as well as to absolute quantity. The proper sewer must be designed with reference to the amount of water it is likely to be called on to discharge within any half hour or hour. This amount varies with different climates, and even with different localities in the same climate. There are, for example, mountain ranges on one side of which rainfall is habitually so much heavier than on the other side that a sewer system properly designed for the one would be manifestly inadequate for the other.

Certain rare accidants of rainfall, corresponding in a way to the cloudbursts of mountain regions, are incapable of being carried off by any sewer system within the range of practicability. Some cities are so situated topographically, built upon flat areas with little fall in any direction, that provision for such rainfall as may reasonable be counted on becomes extremely difficult. In such cases the theory is that the city assumes the risk. In contemplation of law it is under no obligation to build sewers, which are indeed a convenience where they are practicable, but are not a necessity anywhere. And as matter of fact there are more cities on the earth's surface that have no sewers than there are that have. These cities have surface drainage, and some of the more clean and many of them are healthful. More of them are neither, and as a number of these last have attained a certain notoriety their reputation obscures that of the others. In all cases where a sewer system fails of its duty, the onus is upon the city of showing that the particular duty was one that could not reasonably have been provided for.

The overflow of sewers in a number of towns in the vicinity of New York in consequence of extra heavy rainfall affords illustrations of these principles. It seems probable that in some instances the municipalities will be found responsible for the damage resulting to the citizen. For example, it is not enough that a sewerage system be properly designed in general; it must also be proper in all of its parts. Thus each individual case of damage may be referred to the particular sewer that immediately caused it, or to another part of the same system whose failure caused that of the particular sewer. The issue is one involving expert opinion, and even contains its element of the science of meteorology; but it is not one which the common sense of juries need be much at fault or need experience insuperable difficulty in ascertaining the line of substantial justice. In general it is desirable that municipalities be brought to account for the sewerage systems which are sometimes tolerated as an antiquated inheritance, not only to the damage of the individual citizen, but to that of the common weal.—New York Sun.

The above is an excellent statement of the status of the question of municipal liability for damage by overflow of sewers. The "hand of God" which sends excessive floods is usually held responsible for damage which could not be foreseen and provided against. As our knowledge and expertness increases the line between the ordinary and the unaccountable is pushed farther back, and in some cases judgment is in favor of the municipality because there is not sufficient care on the part of the complainant to secure the latest and best technical assistance. All the preceding is a very strong argument for cities procuring the best talent obtainable to design their public works, for arguments and facts which would win a case fifty years ago have no effect now, and errors made by incompetent so-called engineers will involve municipalities in damage suits which can be less successfully defended than in the past.

NEW PUBLICATIONS.

"The Vrooman Act," by Ernest McCullough, C. E. Published by Edward Denny & Co., 207 Montgomery-st., San Francisco, Cal. Price, in cloth, $2; sheep, $3.

Mr. McCullough has in this treatise of the complex legal requirements relating

to public work in California, earned the gratitude of the people whose duties make it necessary for them to know and comply with the law. He tells them in simpler language than the confusing and bewildering legal verbiage of the state laws the required forms and proceedings, and gives a digest of supreme court decisions. It is of indispensable value to engineers, street superintendents and other municipal officers in California who have to do with public work, as well as to contractors and attorneys. Mr. McCullough's experience adds value to his work. He has been a practicing civil engineer in San Francisco for nine years, and is consulting engineer of the Merchants' Association of San Francisco.

"American Portland and Natural Hydraulic Cements," by W. G. Hartranft, Commercial Wood and Cement Company, Philadelphia, Pa.

This little pamphlet of a hundred pages, handsomely printed and freely illustrated, gives much fragmentary information on the general subject of cement, but is devoted specially to the merits of the brands of cement sold by the company of which Mr. Hartranft is vice-president, embracing tests, analyses, views of the work in which it has been used, testimonial letters, etc.

Ninth Annual Statement of the Board of Directors of the Street and Sewer Department of Wilmington, Del., for year Ending Jan. 31, 1896.

This report shows that the work done during the year which it covers comprised 8,599.32 square yards of granite block; 3,514.30 square yards of rubble stone; 32,649.96 square yards of vitrified brick; 12,246.86 square yards of telford and macadam; 11,967.7 cubic yards of street grading; 4,516.9 lineal feet of sidewalk curbing; 1,127.98 square yards of new sidewalks. The city stone-breaker turned out 3,990 cart loads of broken stone and 281 loads of screenings, the cost of which per single cart load was .4536 cents. The most important feature of the publication is the report of Mr. T. Chalkley Hatton, the engineer in charge of the sewer department, which will be editorially reviewed in the next number of Municipal Engineering.

Annual Report of the Street Department of the City of Boston for the Year 1895.

The principal features of work covered in the reports of the superintendent of streets, Mr. B. T. Wheeler, and his assistants, embrace the paving of thirty-five streets with granite block, a number of new streets with telford and macadam, 17,933 sq. yds. of asphalt, building over 33 miles of sewers and 570 catch basins, repairing 561 and cleaning 6,509 catch basins, removing therefrom 18,264 cubic yards of filth, cleaning 11,419 miles of streets and removing 122,544 loads of dirt, sprinkling 338 miles of streets, collecting and removing 336,886 loads of house dirt and ashes and 51,327 loads of house offal. The expenditures of the street department were: For central office, $18,315.79; bridges, $184,724.36; paving, $849,080.80; sanitary, $432,778.52; sewers, $301,468.52; street cleaning, $305,998.50; street watering, $76,424.70; street improvements, $504,-811..1; laying out and construction of highways, $489,616.59; Blue Hill and other avenues, $216,912.53; total, $3,601,945.59. The report of Henry B. Wood, executive engineer, shows in detail all contracts and expenditures.

The sewer construction was 50 per cent. larger than in previous years. This work was all done by day labor, with four exceptions.

The average cost of sweeping streets, including supervision, labor, yard and stable expens s, pro rata of dumps, was reduced from $15.61 (in 1894) to $14.44 per actual mile of street swept. In doing this work 19 double and 21 single sweeping sweeping machines, 12 water carts, 79 street carts, 93 horses and 20 asphalt scrapers were used.

The street watering in previous years was done under contract, with very unsatisfactory experience and last year it was done by day labor, with better results, and at a reduced cost.

Annual Reports of the City Engineer of Providence, R. I., for the year 1895. J. Herbert Shedd, City Engineer.

The expenses of the city engineer's department are shown to have been $49,-267.17, of which $46,283.51 was for salaries, in addition to which $11,221 was paid for engineering services out of the improved sewerage construction account and $5,878 out of the public park account. The question of drainage and sewerage received much attention. Tables of rainfall and meterological observations bearing on the question occupy much of the report. The water pipe system was increased over eleven miles during the year, and the total now amounts to over 296 miles. The receipts from water amounted to $471,070. The net cost of maintenance was $66,396. The construction of the system has reached a total cost in twenty-seven years of $6,119,085.15. A summary of

statistics is set forth in accordance with the suggestions adopted by the New England Water Works Association.

The sewer construction amounted to 33,206 feet in length, varying in size from 6 to 66 inches, circular, and from 16x24 to 66x72, oval.

Highway improvement embraced 1.850 miles of macadam, 2.551 of gravel, 4.631 of asphalt and granite block. Improvements have been ordered, but not commenced, amounting to 4.616 miles.

Annual Report of Commissioner of City Works of Brooklyn, N. Y., for the year 1895.

This report comprises nearly 600 pages, besides tables, maps and illustrations. An important part of it, the report of Mr. Lewis, engineer in charge of street construction and maintenance, has been published in Municipal Engineering in a condensed form.

The receipts for water in 1895 amounted to $1,863,678.06, as compared with a total in 1894 of $1,861,188.86. The maintenance cost was $761,717.29, as against $852,435.29 the precious year. The water debt is $16.196,000 and the annual interest charges $759,939. If payment of the bond is to be made in twenty years $802,450 should be earned and set aside each year, but this has not been done. Increase of pumping stations and extravagant operating expenses diminished the sinking fund proportion to only $15,491 in 1893, but the amount available from 1895 earnings will be $342,022. Reports are submitted by engineers on new sources of supply which will provide an increase of one hundred millions gallons daily.

The mileage of sewers constructed in 1895 was 59.17, of which 4.57 was brick and 54.57 pipe. This was more than double the construction in any previous year since 1876.

The street paving embraced 10.518 miles of granite, 0.227 Belgium, 9.008 asphalt, 0.321 brick, 7.580 macadam and 3.070 cobblestones. Commissioner White says regarding this that it has excited more interest than any other work of the department, and that no expenditure goes so far to make a city attractive to new comers as well as to present residents. He expects it to result in much building in Brooklyn.

Twenty-fifth Annual Report of the New Bedford Water Board and Fifth Quarterly Report on Further Water Supply.

PERSONALS.

Mr. A. McDonald has been elected councilman at Seattle, Wash., to succeed Mr. John H. McDonald.

Mr. F. S. W. Krieger and Mr. R. Canby Smith have been appointed park commissioners at Louisville, Ky.

Mr. P. M. Crapo has been elected chairman, Mr. Charles Starker secretary and Mr. J. W. Brooks treasurer of the new board of park commissioners at Burlington, Ia.

Mr. Gordon H. Taylor, civil engineer and topographer, Boston, Mass., has moved his office from 15 Tremont street to Room 1146, Tremont building.

Mr. Percy L. Banks of Roanoke, Va., has been elected secretary and treasurer of the Consolidated Mining and Construction company at Winston, N. C., Fourth and Liberty streets.

Mr. John Evans has been appointed superintendent of the Warrior Run Water Co., Warrior Run, Pa.

Mr. Walker W. Smith, vice-president of the Stillwell-Bierce & Smith-Vaile Co. of Dayton, O., died July 30.

Mr. Edward L. Bartlett has been appointed a sewer commissioner at Baltimore, Md., to succeed Col. Henry T. Douglas, who resigned.

Mr. James D. Andrews, Jr., has been appointed assistant engineer of the bureau of sewers of the department of city works at Brooklyn, N. Y.

Mr. Thomas C. Woodbury of Portland, Me., has been elected president of the new Omaha Water Works Co., Omaha Neb. Mr. Ellis L. Bierbower has been elected general manager.

Capt. Km. H. Hooker has been appointed supervising engineer of the Belleville and high service pumping stations of the Jersey City water works, to succeed Mr. Wm. S. Miller, who has resigned at Jersey City, N. J.

Mr. Godfrey N. Zingsein, a well-known landscape gardener, died at Newark, N. J., July 30.

Mr. Samuel D. Hall, ex-mayor of Abington, Ill., died at Grafton, Mass., Aug. 4.

Hazen D. Pingree, mayor of Detroit, Mich., has been nominated for governor on the republican ticket.

Mr. J. B. Rielly has been elected mayor at Miami, Fla.

Mr. Jacob M. Shenk has been elected a member of the board of water and lighting commissioners at Lebanon, Pa.

Mr. John C. Copeland has been elected commissioner of public works, at St. Paul, Minn. This office succeeds the old board of public works.

Mr. James Dredge, editor of Engineering, London, England, has been appointed commissioner-general for Great Britain at the the International Exhibition, which will be held at Brussels, Belgium.

Mr. Alphonse Fteley, M. Am. Soc. C. E., engineer of the Croton aqueduct commission, New York, has been appointed chief engineer, and Mr. Charles E. A. Jacobsen consulting engineer of the Passaic River Pollution Commission.

Mr. Garret J. Byrne, city engineer, New York City, died July 20, aged fifty-four.

Mr. Francis E. Mills, civil engineer, Washington, D. C., died July 22 of heart disease, aged seventy-four.

Mr. James E. Campbell has been appointed electrical inspector at Detroit, Mich., which is a newly created position in the commission of public lighting.

Mr. Harry W. Quick, who for nine years has been chief clerk in the department of public works, Philadelphia, Pa., has been appointed assistant to the director of public works.

Mr. Joshua C. Bartley, who for thirty-seven years has served as mechanical engineer in the bureau of water at Philadelphia, died July 22.

Mr. H. A.. Collar, city engineer at Grand Rapids, Mich., has resigned his position.

Mr. Michael Schofield has been appointed superintendent of the water works at Webster, Mass., to succeed Mr. Jas. Brocken, deceased.

Mr. James Simpson of the firm of Simpson Bros., cement dealers of Newton and Boston, Mass., and Chicago, Ill., died Aug. 12.

MACHINERY AND TRADE.

RECENT INVENTIONS.

[Reported specially for MUNICIPAL ENGINEERING, by A. I. Gardner, Attorney at Law and Solicitor of Patents, Loan and Trust Building, Washington, D. C. Copies of any patent can be secured for ten cents each.]

564,049. Apparatus for Purifying Water—J. H. Curtis, St. Louis, Mo. An air chamber is located beneath a suitable receptacle, a body of filtering material sustained between the receptacle and the air chamber, a body of filtering material located in the bottom of the air chamber, perforated plates horizontally positioned with the air chamber, bodies of filtering material located upon said perforated plates, and tubular connections for discharging compressed air into the air chamber.

563,874. Apparatus for Cutting or Grooving Road Beds—M. J. McQuade, Bayfield, Wis. The combination with an adjustable gouge-cutting knife mounted on a block carried within a recess in the runner, of a fender mounted on a plate vertically adjustable on a dovetailed guide-piece.

564,013. Street Cleaner—R. W. Furnas, Indianapolis, Ind. Consists of a dust-collecting chamber, an engine, a drum to which steam is conducted from the engine, and pipes leading from the drum to the dust-collecting chamber for introducing steam into the latter.

564,164. Bascule or Tilting Bridge—E. S. Shaw, Cambridge, Mass. A bridge containing a fixed cantaliver arm or portion projecting horizontally from a pier, and a bascule, or counterweighted, tilting, or upward and downward turning portion, pivoted upon or near the end of the said cantaliver arm.

563,773. Electric Arc Lamp—J. C. Knight, Roselle, N. J.

564,475. Sewer Gas Trap—G. J. Dehn, Iron Mountain, Mich. A sewer gas trap, provided with a body, a cap screwing in the bottom of the body, and carrying a valve for closing the inlet to the said body, and a small cap screwing on an apertured externally-threaded plug located on said first-named cap.

564,411. Ventilating Apparatus—G .O. Miller, North Tonawanda, N. Y. Reissue No. 11,559. Electric Arc Lighting—G. R. Lean, Cleveland, O. The combination with an arc lamp having a separating and feeding magnet and an armature for said magnet having aflange, of a coil included in a shunt between the terminals of the lamp, and a cut-out included in said shunt circuit, said cut-out comprising a

rigid and a spring arm normally in contact with each other, the spring arm having a projection normally disposed in the path of the flange on the said armature.

560,940. Method of Purifying Water—G. R. Sellers, Wilmington, Del. The method of purifying water which consists in agitating therein pieces of iron in drect contact with pieces of another metal which with the iron can form a galvanic couple so as to facilitate the formation of an iron salt, soluble in water.

564,610. Water Sprinkler. E. R. Gill, Independence, Mo.—A supporting shoe omprising a U-schaped rear portion and an angular front portion, the vertical part of which is slotted and provided with an opening to receive the sprinkler, which is adjustably held therein by the two sections formed by the slot.

564,771. Electric Arc Lamp. W. C. Armstrong, New York, N. Y. The works of this lamp are provided with an outer and inner cover and a chimney of reduced diameter, the outer cover being fitted to slide up and down along the chimney of the lamp and to inclose the inner cover when the lamp is sealed.

564,776. Filter. J. A. Bowden, etroit, Mich.

564,772. Electric Arc Lamp. W. C. Armstrong, New York, N. Y. An electric lamp provided with works, a chimney above the works, a base to support the works and a cover which incloses the works and is closed at its lower end by the base on which the works rest and is free to slide up and down the chimney.

565,044. Street Lamp. J. Stewart, Chicago, Ill.

565,042. Broom. L. T. M. Slocum, Chicago, Ill. A street-sweeping broom consisting of a back having attached bristles and a shield secured to the back and constructed with a plurality of slits forming independent elastic teeth, the outer extremities of which lie coincident with the outer ends of the brstles and bear against the surface being swept while the bristles are sweeping.

565,020.—Bridge. J. I. Newburg, Vicksburg, Miss. Comprise a pier or abutment, an arch having its girders arranged at one end in the pier or abutment and a second arch having its girders arranged at one end in the pier or abutment and lapping and connected with the girders of the first-named arch within the pier or abutment.

AN ELECTRIC STREET SWEEPING CAR.

A new self-loading car, which works by electricity, sweeps the dirt up, carries it away and dumps it mechanically, has been invented by A. Jackson Reynolds, an American by birth, but now a resident of Montreal, Canada. The car is constructed and is to be operated much the same as the torlley car, being run on an electric line, when one exists, but is also fitted to run on any tracks. The plan is to sweep the street from curb to curb inwardly toward the tracks, and when the self-loading car passes over tracks it takes up the refuse and conveys it to any desider location. The car is twenty-two feet long, eight feet. wide The motors and brakes are above the wheels and axels, so as not to impede the action of the dust brushes. Sweeping and loading is done by means of three large rotary brushes placed across the center of the car, which work on much the same principle as a carpet sweeper, and are covered with steel casings with proper outlets for discharging the sweepings into the body of the car. By the simple pressure of a lever it can be run backward as well as forward. The brushes make five revolutions to each one made by the car wheel, and this high brush speed forms a powerful suction, which takes up all refuse matter and deposits it into the body of the car, the loading capacity of which is equal to fifty carts; there is is retained upon a floor, which works upon a pivot and which, with a single turn, instantly deposits the dirt at any necessary point. The brooms of the car may be extended so as to take in the whole street. The estimated cost of operating the electric sweeper, when used only to sweep and load the collected matter between the car tracks, is $3 a mile. It can be operated successfully in removing the snow as fast as it falls, however heavy the fall may be. The inventor claims that two such sweepers would keep the tracks and roadway clear so that traffic would not be interrupted for a minute.

TESTS OF VULCANITE PORTLAND CEMENT.

The nine months' test of Vulcanite Portland cement, reported during the last month by Lathbury & Anderson, the chemists, shows an average tensile strength of 400 pounds, which makes a very good showing of increasing tensile strength of this very promising new

brand of Portland cement. The previous tests show the following average: Seven days, 213 pounds; one month, 341 pounds; six months, 365 pounds; the first two with 11 per cent. of water and the last two with 12 per cent.

TRADE NOTES.

Canton, Ill., has begun the manufacture of paving brick.

The purchase of a steam roller has been authorized at Hornellsville, N. Y.

Paving brick will be manufactured at the West Side Tile Works, Macomb, Ill.

The Jensen Paving Company, Portland, Ore., opened its first kiln of paving brick recently.

A new brick and tile factory will be established at Creston, Ia,. by parties from Audobon.

The purchase of an engine for the rock crusher, at a cost of $800, is proposed at Raleigh, N. C.

Additional machinery is being added to the plant of the Hamburg Vitrified Brick Works, Tilden, Pa.

A bridge construction plant has been built at Ridgedale, Tenn., by W. H. Converse and is now in operation.

The street committee, Joliet, Ill., has been ordered to investigate and report on stret sprinklers and road rollers.

The organization of a new fire clay company is one of the contemplated industries for Altoona, Pa., by Ohio parties.

The Mt. Diablo sewer pipe and paving brick company succeeds the title of the Antioch pottery company, Antioch, Cal.

The plant of the Michigan City Stone brick company, Michigan City, Ind., will be sold at public auction by order of the court.

A plant for the manufacture of paving brick will be located in Leavenworth, Kas., by Robert Nasch of Pittsburg, Kas., and M. H. Carr.

It is said, at Springfield, Mass., that after Ferry street is macadamized several street sweepers will be needed to keep the street in a cleanly condition.

The plant of the Philadelphia Paving and Contsruction company, manufacturers of asphaltina, Philadelphia, Pa., was destroyed by fire Aug. 2. Loss, $12,000.

A float, with two cars containing asphalt, belonging to the Barber Asphalt Company, sank at the foot of W. Forty-ninth street, New York City, Aug. 11.

The works of the Columbus Sewer Pipe Company, Columbus, O., which have been closed to make necessary repairs, are about ready for operations to be resumed.

Bids are solicited for two street sweepers by Mayor Stienbach, Quincy, Ill. The finance committee has been authorized to purchase two at prices not exceeding $400 each.

The Mendota Tile Company, Mendota, Ill., has a contract for furnishing that city with sidewalk brick and brick for crossings, of which they have 500,000 on hand now.

The special council committee appointed at Wauson, Wis., to investigate street paving and road machines, visited Madison, Mauston, Janesville and Stevens' Point, Wis., and Rockford, Ill., for that purpose.

The works of the Ohio Valley Fire Clay Company, Toronto, O., have been closed down for an indefinite period, in compliance with an order sent out by the Central Sewer Pipe Company to close all the combine plants.

The Williams Block Paving Company, Oakland, Ca., has been incorporated to pave streets, roads, lanes, alleys and places in Oakland and elsewhere in the county, with the pavement known as the Williams block pavement.

A number of capitalists of Reading, Pa., are interested in the organization of the Reading shale brick company. Among the incorporators are: James K. Getz, Hiram Getz, John Barney, William W. Seltzinger and P. E. Yeager.

A contest was held between a road scraper and eight men Aug. 5 at Lowell, Mass., which resulted in a tie. The members of the committee on streets are inclined to favor the adoption of the street scraper, which is the invention of James L. Forsythe.

Bids for steam road-rollers have been received at Taunton, Mass., as follows: O. S. Kelly Co., Springfield, O., $2,500; Enterprise Manufacturing Company, Columbiana, O., $2,500; Harrisburg Fuondry and Machine Works, Harrisburg, Pa., $2,-850; Pitts Agricultural Works, Buffalo, N. Y., $2,650.

The Consolidated Engineering Company has been incorporated by engineers and contractors at New Orleans, La., who will undertake all classes of engineering, designing and contracting. P. F. Chanute is president and C. M. Pasquier is vice-

president and general manager of the company.

The Waukesha Water company has been organized at Waukesha, Wis., to succeed the old Hygeia Springs company. The officers of the company are: President, James K. Anderson, Kansas City, Mo.; vice-president, Samuel L. Jarvis; secretary and treasurer, L. C. Conklin, Kansas City, Mo.

The plant of the South Bend Cement Company, South Bend, Ind., has been purchased at sheriff's sale by George A. Jenks, of Pennsylvania, and John E. Dubois, of Chicago, who held claims against the company for $13,985.22 and $12,222.56 respectively. The sale wil lresult in shutting out a number of smaller creditors.

A part of the North Chicago works of the Illionis Steel Company has been converted into a cement plant, and waste furnace slag is being turned into "Illinois Steel Portland Cement." The slag is granulated in water, mixed with lime and other ingredients and then ground into powder and put into bags for market.

B. M. Shanley, Newark, N. J., and John D. Crimmins of New York City will probably abondon the project of building a trolley road between Elizabeth and Westfield, owing to the unwillingness of the country authorities to grant them the use of the macadam road. Ricker Bros. of Newark will probably apply for the franchise.

The action which precipitated the appointment of a receiver for the Royal Clay Manufacturing Company, Uhrichsville, O., is now considered ill-advised, as the affairs of the company are steadily improving. The receivers, J. M. Cooper and T. J. Evans, received an order from the court during the latter part of July to place the plant in operataion as quickly as posisble.

The Howe Pump and Engine Works, Indianapolis, Ind., was placed in the hands of a receiver Aug. 3. Edward S. Gaylord, treasurer, was appointed receiver. The assets of the company amount to between $120,000 and $150,000; liabilities, less than $50,000. The officers of the company stated that it is impossible, under the condition of the money market, to sell the town bond securities owned by the company, and in which it deals heavily. The company builds pumps and engines and constructs water works and municipal electric lighting plants. L. M. Howe, a member of the company, says the cause of trouble lies wholly in the agitation for a debased money, which has destroyed private and municipal credit.

A valuable deposit of gravel beds has located on the city's property north of Mynster Springs, in Lake View, at Council Bluffs, Ia. A portion of the stratum is a conglomerate mass of clean, coarse gravel, so firmly cemented together that masses weighing tons can be quarried. It is easily broken up with picks and hammers, and is pronounced equal to macadam for road-making purposes. An explosion of a blast of powder threw up great masses of conglomerate stone and made way for further exploration of the depths of the deposit, when it was found to have a thickness of about ten feet, and lies on a bed of firm, blue clay. A few hours' work with shovels uncovered an area that is estimated to contain at least thirty car loads of clean gravel.

The Mica Roofing company, Indianapolis, Ind., began the work of creosoting cedar blocks for use in street pavements Aug. 1. The plant embraces a large iron cylinder 70 feet long and 6 feet in diameter; at one end is a door through which five cars loaded with blocks are placed inside the cylinder. The cars are made of iron strips, which enables the creosote to pass entirely through the blocks, which, instead of being stacked on the cars, are thrown in promiscuously, thus giving all sides an equal opportunity of coming in contact with the creosote. First, the blocks are subjected to a heat of 30 0degrees within the large cylinder, and the creosote is then pumped in until there is a high pressure in the tank; this aids in forcing the creosote into the blocks, although a large amount is absorbed owing to the temperature of the blocks; the temperature of the creosote is only 100 degrees. The capacity of the plant is about 50,000 blocks in twenty-four hours.

Bids were received Aug. 17 for four steam road rollers by the Massachusetts Highway Commission, Boston. The bids for the four rollers were so satisfactory that two extra ones were ordered under the same conditions as the four called for by the proposals. The six machines will cost $11,325, leaving a balance of $675 out of an appropriation of $12,000 for the purchase of a stone crusher. The towns to which the road rollers go are Greenfield, Westfield, Ware, Palence, Natick and Winchester. The stone crusher has been purchased for Palmer also. At the

expense of the commonwealth, one or more steam road rollers, portable stone crushers, and such other road machines as the highway commissioners may deem necessary will be furnished for use in constructing and maintaining roads in the towns requesting the machines. These when furnished remain the property of the state, but are operated and maintained under the direction of the county commissioners. Competent engineers and skilled mechanics are engaged to operate the machines, a dnare paid by the commissioners, who in turn collect from the various towns the amount of expenses incurred in the work of each place. Towns are provided with machinery in the order in which applications are made.

SELECTIONS FROM THE PRESS.

RELATION OF ALLEYS TO PUBLIC HEALTH.

The action of the Commissioners of the District of Columbia in paving the alleys of Washington with vitrified brick, is commented on by the Times as follows: This work not only makes the alleys more presentable, but is in the line of scientific sanitation. In the majority of large cities alleys and courts are lurking places of disease. The people who for the most part dwell there are not, as a rule, specially devoted to the observance of the canons of cleanliness, nor careful about the maintenance of sanitary regulations, and it is incumbent upon municipal authority, therefore, to step in as a regulator, so far as this is possible, not merely on account of the residents of the alleys, but in order to safeguard the health of the whole community. The health authorities of nearly all large cities are beginning to appreciate this fact, and consequently a great deal more attention is now being paid to alley sanitation than was the case only a few years ago. Washington is no exception to the general rule, although the unsanitary condition of the alleys here has not been, and certainly is not now, as pronounced and aggravated as elsewhere.

In this matter, as in a great many others relating to municipal sanitation, local authorities in the United States might profitably learn from the example of the towns of Holland. Scrupulously clean about their homes, the level-headed Dutch burghers also pay the strictest attention to highway and byway.

There is hardly a street, and not a court or an alley—wherever such exist, their number constantly decreasing—through which a streamlet of pure water does not unceasingly flow in a capacious gutter, emptying into a sewer opening of sufficient size to receive the rubbish and debris that is swept into the gutter by the dwellers in these places. In consequence of the simple, yet most effective sanitary precaution, zymotic diseases are most rare in the towns of Holland, and no nauseating smells offend the nostrils, nor disgusting dirt meets the eyes of the visitors to them. The system, of course, is not at all expensive.

In paving or repaving the alleys of Washington, some innovation like this, it would seem, might easily be introduced. The only possible obstacle in the way of it at the present time would be the scarcity of our water supply, but as this presumably will be remedied within the next two or three years, the construction or reconstruction of the alleys might be carried forward in such a manner as to make them all ready for the purifying streamlet whenever the city gets water enough to stand sa useful a waste of it. A hydrant placed in each alley from which the water would flow incessantly would not only serve the designated purpose, but also give the residents there all they need for domestic use. In this way a great public benefit would be secured and the classes that most need it furnished with an abundant supply of good water, free of cost, while the expense to the city would be comparatively trifling.

ELECTROLYSIS SUIT OF OMAHA WATER WORKS COMPANY.

When suit was brought, nine months ago, against the Omaha Street Railway, by the trustee of the water works company of that place, for $250,000 damages to the pipes of the water works system by electrolysis, the interest of the entire street railway fraternity was aroused, as this wsa the first suit ever brought of such a nature. At first thought it seems rather strange that considering the length of time the damage possible from electrolysis has been known, that some suit should not have been started before. The fact that all has been so peaceful between the electric railway and water works companies, can only be accounted for by the willingness usually displayed by electric railway managers to remedy the vil, and by the relatively small amount of the actual damage done. But now even the Omaha case has been dis-

missed by the plaintiffs, an event on which the electric railway industry may justly feel cause for congratulation. The history of this case is as follows, and is one in which both the Omaha and every other street railway in the country may be well satisfied The Farmers' Loan and Trust Company, which had the water works in hand, became alarmed by the reports of certain experts regarding the effect of electrolysis on the pipes, and probably honestly believed that they were badly damaged. Suit was brought for $250,000. It was not an easy matter to prove absolutely to the contrary, as the pipes were all buried, and the particular point near one of the power houses, which had not been properly connected, showed damage for a block or more from electrolysis, and had to be relaid, making it look, of course, as if the trouble might soon extend over a large territory. But by great good luck it happened that in compromising some other matters with the city and insurance people, the water works company agreed to relay with larger pipe nearly all its mains in the business part of the city. This was all done last fall, and of course the uncovering of the pipes in all that district which was thickly covered with street railway lines was watched with interest by all parties concerned. Experts from both sides were constantly on hand. The result was satisfactory to everybody, as it was clearly developed that there was no electrolytic action except at one or two spots, and even there it was doubtful whether it was electrolysis. It was but natural when the water works people found that they had practically no grounds for damages, that they should ask to have the suit dismissed, as they probably felt that the slight injuries they had sustained could be adjusted without recourse to the courts. The outcome will have a beneficial effect in quieting the fears of many a water works man, and enabling electric railway managers to "sleep better o' nights."—Street Railway Record.

WHY NOT A GREAT STATE HIGHWAY?

So much has been written and said on the subject of good roads during the past few years that there is danger of the public becoming tired of the subject before anything tangible is in the way of being accomplished. This, however, should not be. The question is one of the highest importance, involving enormous sums of money to the country at large, and all such questions have to be preceded by a period of general discussion before much good is accomplished. So far, the result of the widespread publicity that has been given to the subject of road improvement has had the good effect of educating the public mind, so that now it is no longer a question of whether we need improved roads, but of the best way to work in order to get them.

The last legislature passed some good legislation on the subject of roads. A bureau of highways was created, the law requiring that the commissioners should visit each county in the state at least once a year. It was also provided that the supervisors were to be ex-officio road inspectors in their respective townships, instead of selecting road overseeers as previously without regard to the fitness of a man for the position, the supervisors were required to let out road improvements by contract, and to see that the work was carefully executed. Much benefit was expected to accrue from these laws. The good results are not yet very evident, but it must be recognized that California is a large state and the job of making good roads throughout it is not a small one.

Probably one of the best things that could be done as a beginning in making a complete system of good roads throughout the state would be to build one great trunk road from Siskiyou to San Diego. Such a road, constructed after the most approved methods, would not only be a great advantage to the people along its route, and open their eyes to the shortcomings of our present road system, showing our people that we are far behind the Romans, who built roads 2,000 years ago that are in good condition today, and this in a climate very similar to southern California, where there are long spells of dry weather. The state might aid such a road by the donation of rock from the Folsom quarries, the other work being undertaken by the various counties along the route. It might also be a good plan to plant along the sides of such a state highway nut and olive trees, which would not only afford a grateful shade in summer, but in course of time might yield enough to defray the cost of keeping up the road. This plan is successfully followed in some of the European countries. It would not then be long before the various counties and towns would be anxious to construct short branch roads, on the same principle, to connect with the main highway. This is a suggestion that is well worth consideration by the next legislature.—The Investor, Los Angeles, Cal.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Worcester, Mass.—The experiment of using ahphaltina for street paving was begun in Plymouth-st., Aug. 10.

Evansville, Ind.—A test of the brick to be used in the recently awarded paving contracts was made Aug. 12 by the board of public works.

Erie, Pa.—Henry Mayer & Sons began paving Chestnut-st., from Fourth to Eighth, with asphalt, recently. The contract for this work was awarded in June, 1895.

Jacksonville, Fla.—The work of paving St. George-st. with brick, from the post-office to the city gates, at an expense of $8,000, will begin Oct. 1.

Tiffin, O.—The street committee of the city council visited Zanesville, Akron and Canton recently on an inspection tour of paving brick manufactories.

Atchison, Kas.—The intersection at Fifth and Kansas-aves. will be paved with Indian Territory asphalt at actual cost, by a company which desires to secure a paving contract in this city.

Kalamazoo, Mich.—Complaint is made that the price paid for a brick pavement which is being laid in this city is too high—that it will cost $2,700 more than the same pavement in South Bend.

San Francisco, Cal.—Ernest McCullough, consulting engineer for the Merchants' Association, will supervise the laying of a new bitumen roadway on Folsom-st., between Third and Sixth.

New Britain, Conn.—A proposition has been made to the effect that each member of the common council, including Mayor Vance, make a personal subscription of $200 for the expense of paving Main-st. with asphalt.

San Francisco, Cal.—A vitrified brick pavement will be laid in the street on which the building belonging to D. O. Mills fronts, and it is thought the result of the experiment will prove valuable in determining the future pavement of Market street.

Topeka, Kas.—The proposition of the Barber Asphalt Paving Company, agreeing to put all asphalt pavements in first-class condition and keep them in repair for five years for 4 cents per square yard per year, has been accepted.

Lake Forest, Ill.—The council and the residents are divided on the subject of street paving and other municipal improvements, the property-owners protesting against the proposed action of the council in ordering the work done.

Syracuse, N. Y.—Holes have been bored into the strip of pavement laid in Warren street by the Asphaltina Paving Company and oil destructive to asphaltina poured in. A reward of $200 has been offered by Duncan W. Peck for the apprehension of the guilty persons.

Eau Claire, Wis.—The special committee of aldermen which has ben investigating street paving in Winona and La Crosse are much pleased with what they saw of brick paving, and are unanimous in the opinion that it is the proper thing for business streets.

Indianapolis, Ind.—An experiment is being tried on the creosoted block pavement by City Engineer Jeup. Instead of being laid straight across the street at right angles with the curb they are being laid obliquely. This will, he thinks, prevent their wearing out so soon.

Lancaster, Pa.—(Special.—This city has put down one block of Mack block on a macadam or loose stone foundation, and is putting down two more blocks on Orange street with sand filter.

Denver, Col.—The temporary injunction granted July 24 restraining the Board of Public Works from signing a contract for paving lower Fifteenth street and Broadway with F. O. Blake & Co., will probably delay the paving until next year. The injunction was brought about by Edward Murphy of Omaha.

Des Moines, Ia.—The Des Moines Brick Manufacturing Company has received notice from the Board of Public Works that unless the defects in certain streets are remedied within a reasonable time the repairs will be made by the city and the cost thereof charged to the company and its ureties on bonds.

Des Moines, Ia.—Relative to the width that the street car company shall be required to pave City Solicitor Macomber gives as his opinion that the city shall require the company to pave, maintain and keep in good condition seven feet of pavement, three and one-half feet each way from the center of the track.

St. Paul, Minn.—Henry M. Stow, Chicago, has brought suit in the United States court, through his attorneys here, against the city, placing damages at $300,000 and alleging that he was the owner of a patent for improvement in wood pavements, and that the pavement was used by the city of St. Paul, which gave him no royalty.

Milwaukee, Wis.—Alderman H. C. Schranck left Aug. 10 for an extended eastern and northern trip with the intention of incidentally making a close study of paving in the most important American cities, for the purpose of get-

ting data for an elaborate report on street pavements by the special committee of which he is chairman.

New Britain, Conn.—A report of its work of inspection of the different kinds of street paving was made by the sub-committee of the street committee Aug. 4. Sheet asphalt was recommended for Main-st., and the full committee unanimously voted to accept the report of the sub-committee and refer it to the common council as a recommendation from the street committee.

Philadelphia, Pa.—Bids have been opened for paving thirty-five streets in various parts of the city, but through an oversight the bills to pave these streets were passed before fourteen of them had been graded, and before ordinances to grade them had been passed. The contracts for paving cannot be given out until the contracts for grading have been awarded.

Chicago, Ill.—The property-owners on Warren-ave. have protested against the repaving of that street at the present time for the reason that Madison-st., from Rockwell west, is in such a deplorable condition that if Warren-ave. is asphalted the heavy teaming will be transferred from Madison to Warren, with the result that repaving would again be necessary within two years.

Sioux City, Ia.—The Sioux City gas company claimed recently that its contemplated street paving would put them to heavy expense, and as its franchise terminated in three years, it thought it unfair for the council, in view of this fact, to expose it to the danger of losing its franchise, whereupon the aldermen agreed to grant a twenty-year extension. It is now contended that the extension is properly the business of the council of 1896.

Defiance, O.—This city has been enjoined by Frank Ferguson, a tax-payer, from awarding to Hallwood& Hill the contract for paving Holgate-ave. on the ground that the bid of the Barber asphalt paving company was lower than Hallwood & Hill's, and secondly, that the city cannot legally award the contract to any one, as there is no money in the fund for the improvement, as is required by law. The Barber asphalt company has also instituted mandamus proceedings to compel the acceptance of its bid.

New Haven, Conn.—The street committee, which made a tour for the purpose of inspecting the streets in several of the principal cities, reported the accumulation of information of much importance on the subject. The party consisted of Mayor Hendrick, Aldermen Hamilton and Rattledorfer and councilmen Clark, French and Norris. Newark and Trenton, N. J., Philadelphia, Pa., Poughkeepsie, N. Y., Middletown, Conn., West Cumberland, W. Va., and Easton, Pa., were the cities visited. The object of the trip was to ascertain which kind of brick will be best to use on Asmuh and Wooster streets. J. E. Miles has the contract for the paving and the city will furnish the brick.

Harrisburg, Pa.—Since the 1st of April, 1896, about 125 new crosisngs have been laid and over 1,475 square yards of asphalt block used, making every crossing substantial and capable of wearing for years. New asphalt pavements were also laid in front of the Mt. Pleasant, Citizen Washington and Hope fire engine houses.

Philadelphia, Pa.—The railway companies have served notice upon the city authorities that they will not be responsible for the maintenance of pavements that are torn up by other corporations. While a provision is made in each grant of privilege for laying conduits and underground wires that the pavement must be replaced, in many instances it is allowed to remain open a long time, and in others it is found that when an attempt has been made to repair it, the work is very inferior. The question of maintenance will, it is thought, be taken to the courts.

New York, N. Y.—Suit has been begun by Kelly & Booth against the public works department to compel the commissioners to open and receive their bid for paving Fifth avenue with asphalt. The commissioner of public works did not open the bid presented by this company for the reason that the contractors failed to file with him, prior to the opening of the bids a certificate duly attested, setting forth that the grade of the asphalt had been used satisfactorily in some city or town. The company alleges that their bid was lower than the California Asphalt Company, to whom the contract was awarded, and that their formula of pavement, known as the California Standard, has been used at Fresno, Cal., and Ogden, Utah; also, that the price to be paid by the city is excessive. To this Commissioner Collis replied that as the contract provides for keeping the pavement in repair for fifteen years, it is not a high figure.

CONTEMPLATED WORK.

Moberly, Mo.—Clark-st. will be paved.

St. Joseph, Mo.—Paving is proposed for Eastern highway.

London, Ont.—Brick paving is contemplated for Market lane.

Sandusky, O.—Brick paving is contemplated for Tiffin-ave.

Oakland, Cal.—About fifteen miles of streets are in need of repairs.

Springfield, O.—About $5,000 worth of street improvement bonds will be sold Sept. 15.

Port Huron, Mich.—A petition is being circulated for repaving Pine Grove-ave.

Duluth, Minn.—Cedar block paving is contemplated for First-ave., west, for next season.

Brookfield, Mo.—Paving is proposed for the business portion of Main-st. this fall.

Kansas City, Mo.—Michigan-ave., from Twelfth to Sixteeenth-sts., will be paved with asphalt.

Albany, N. Y.—A petition has been presented to council to pave Washington-st. with brick.

Youngstown, O.—Sheet asphalt paving will be laid over the present brick pavement on Wick-ave.

Los Angeles, Cal.—Paving is being agitated for Fourth-st., between Main and Spurgeon-sts.

Wilkesbarre, Pa.—A resolution has been passed for repaving South-st. with vitrified brick.

Nashville, Tenn.—Senir-st., from Sixth to Seventh, in front of Boscobel College, will be macadamized.

St. Paul, Minn.—About twelve miles of macadam road is contemplated for next year at a cost of about $100,000.

Ann Arbor, Mich.—The plans and specifications for macadamizing Detroit-st. have been referred to the council.

New Britain, Conn.—The citizens will vote on the question of issuing $30,000 in bonds for street improvements.

Detroit, Mich.—Hazelwood-ave., from Woodward to Second, will be paved with cedar blocks on concrete foundation.

Meridian, Miss.—About 20,000 square yards of paving is contemplated, and vitrified brick has been adopted for the material.

Houston, Tex.—Specifications are being prepared for a new shell road between Harrisburg and Deep Water, about seven miles long.

St. Louis, Mo.—An ordinance has been passed providing for paving Twelfth-st., from Market to St. Charles, with asphalt.

San Francisco, Cal.—The estimated cost of bituminizing Market-st., from the ferries to Valencia-st., is $149,600.

Elburn, Ill.—Asphaltina sidewalks will be constructed, the property-owners and the village paying one-half each of the cost.

Chattanooga, Tenn.—A map of a boulevard, from Jay's mill to Ringgold, Ga., eight miles, is being made by Engineer Betts.

Ottumwa, Ia.—An ordinance, creating paving district No. 52, and defining the boundaries thereof, has been passed and approved.

Sistersville, W. Va.—An expenditure of $35,000 for brick paving and $8,000 for sewers is contemplated. J. R. Sweeney, Clerk.

Schenectady, N. Y.—An ordinance favorable to sheet asphalt paving for S. Center-st., from State to Hamilton, has been adopted.

Niles, O. (Special)—Wm. Wilson, assistant city engineer, says a part of Main street, about 5,000 square yards, will probably be paved.

Columbus, O.—Pearl street, from Fulton street to Livingston avenue, will be paved with asphalt, stone block or brick, with a 5-inch curb of Berea, Fulton, Sunbury or Iberia stone. J. M. Doane, City Clerk.

Champaign, Ill—Paving is contemplated for Walnut and Taylor streets. The kind of paving material has not yet been decided upon, but a concrete foundation is favored.

Duluth, Minn.—The work of building a road to Eveleth, 62 miles, will be let in five contracts by the St. Louis county commissioners.

Atlanta, Ga.—The question of expending $40,000 to aid in the improvement of roads in Lakewood is being considered by the council.

Rutherford, N. J.—The council of East Rutherford contemplates issuing bonds for macadamizing the streets and for sewer construction.

Willmette, Ill.—Press reports state that an ordinance has been prepared for passage providing for novaculite paving in Sheridan road.

Evansville, Ind.—Church street, from Chestnut to Oak, will be paved with brick. The alley between Grant and Line streets will also be paved.

New York, N. Y.—The circle at the junction of Fifty-ninth street and Eighth avenue will be paved with asphalt. This has just been decided upon.

Allentown, Pa.—The question of issuing $350,000 in bonds for improving the streets and constructing sewers will be voted on in October.

Blairsville, Pa.—The council has disposed of $10,000 worth of borough bonds, the proceeds from which will be used in street improvements.

Brooklyn, N. Y.—City Works Commissioner Willis has asked permission of Mayor Wurster to repave McDonough street, from Tompkins avenue to Throop avenue, with asphalt.

Newark, N. J.—Holland street, from Springfield avenue to S. Tenth street, will be paved with asphalt. Bloomfield avenue will probably be ordered widened to 75 feet.

Newark, N. J.—The Fourteenth ward improvement association and the Belmont avenue association contemplate consolidating. Better paving and sewerage are being considered.

Indianapolis, Ind.—The common council passed ordinances Aug. 10 for cement sidewalks on N. Delaware street, from Massachusetts avenue to Seventh street, aggregating about three miles.

Eau Claire, Wis.—The property-owners on River street, below Kelsey street, will petition the council for about two blocks of vitrified brick paving, the expense to be borne by them.

Springfield, Mass.—Harrison street, from Main to Dwight, will be paved with sheet asphalt, and S. Main street, from William, will be paved with brick as far down as the appropriation will permit.

Portland, Ore.—An ordinance was passed Aug. 8 for improving Washington street. Vitrified brick paving is favored by the citizens for First street, from Couch to Stark, thence south to Madison.

Springfield, Mo.—Paving is contemplated for Jefferson street, from Center Commercial. Joplin gravel will be the material. Brick paving is proposed for the incline, from Center street to Phelps avenue.

Cincinnati, O.—Asphalt paving is proposed for Spring Grove avenue for the purpose of making it the north side boulevard. Harrison avenue will be widened from 20 to 36 feet, at an estimated cost of $13,000.

Camden, N. J.—The county board of freeholders has voted to build 11 miles of gravel road, from the stone road at Berlin to the Atlantic county line, thence to connect with the county road now in course of construction.

Chicago, Ill.—The South Shore Drive Commission has been organized to build a drive along the lake shore. John G. Shortall, George H. Hess, W. K. Read, Almon Brooke, Ed Morrimer, William Barton Payne and James Morgan are the directors of the commission.

Grand Rapids, Mich.—Coldbrook street, from Taylor to Canal, will be macadamized, including the construction of the necessary bridges, culverts, gutters, crosswalks, manholes, catch basins, approaches and cesspools. S. Waterloo street will also be graded and graveled.

Rock Island, Ill.—The ordinance to improve the levee, at a cost of $35,000, passed the council Aug. 17. This includes the paving of First avenue, from Sixteenth to Twentieth street, with vitrified brick; streets leading north of the railway tracks to the water's edge, Anamosa paving blocks, intervening spaces with retaining masonry macadam.

Bloomington, Ill.—The list of streets that will be paved next year includes W. Grove, E. Market, E. Fourth and S. McLean-sts. There is also some talk of paving W. Wood, from Allen to Morris-ave., and Morris-ave. north to Market-st., and perhaps Clinton-st. The residents of S. Clayton-st. are anxious that the paving will be continued from the present terminus at Bell-st. to Lincoln-st.

New Bedford, Mass.—Estimates for the proposed paving of Amherst-ave., from the New York, New Haven & Hartford railroad to Sawyer-st., are as follows: Block paving, $10,000; macadam, $4,480, to which would be added $3,220 for repairing 4,600 feet. Curbing and gutters have been ordered laid on Cottage-st., and Superintendent Lawton has been authorized to order enough curbing to make the total amount for the year 20,000 feet.

CONTRACTS AWARDED.

Tiffin, O.—Bids were received Aug. 14 for paving Adams, Lafayette and Water-sts with brick.

Athens, O.—The contract for laying 456,200 paving brick was awarded to W. J. Berry of Dillies Bottom, O.

Long Branch, N. J.—John F. Shanley, Newark, was awarded the contract for five miles of macadam road for $40,504.

Kokomo, Ind.—The contract for paving the public square with brick was awarded to Fletcher Ruddell for $15,000.

Santa Ana, Cal.—The Main-st. bridge will be paved by the Los Angeles paving company at 7¼ cents a lineal foot.

Seattle, Wash.—The contract for constructing six miles of the Miller river road was awarded to J. A. Bailey for $4,500.

Menasha, Wis.—The contract for removing and paving the triangle was awarded to J. H. Greene & Son, Appleton, Wis.

Galion, O.—Raymond & Baker, city, presented the lowest bid Aug. 10 for grading and macadamizing Charles-st., $2,650.

Miamisburg, O.—M. G. Cain secured the contract Aug. 19 for paving Main-st. with Hallwood block at $1.50 a square yard.

Sioux City, Ia.—The Warren-Scharf Asphalt Paving Company secured the contract for paving with asphalt Fourth-st. at $2.39 a square yard.

St. Paul, Minn.—Hennessey Bros. & Cox secured the contract for paving Jackson-st., from Seventh to Ninth, with asphalt for $6,733.

Winnipeg, Manitoba.—Doidge & Co. secured the contract for block pavement on Elgin-ave. for $2,200 and on Main-st. for $2,780.

Wilmington, Del.—The contract for 15,000 square yards of vitrified brick paving was awarded to A. S. Reed & Bro. Company at 4¾ cents a square yard.

Deep River, Conn.—The contract for macadamizing a portion of Main-st. was awarded to George H. Sage of Berlin, Conn., at $1.18 a lineal foot.

Richmond, Ind.—John F. Cronin was awarded the contract for about one block of brick paving.

Denver, Col.—The contract for grading and curbing in Capitol Hill district No. 1 was awarded to Charles B. Rhodes for $120,523.45.

Muskegon, Mich.—R. K. Meagher, Bay City, was awarded the contract for repaving Western-ave. with cedar blocks at 47½ cents a square yard.

Greenwich, Conn.—The contract for constructing a Telford macadam road was awarded to John O. Merritt of Port Chester, N. Y., at $2.74 a lineal foot.

Louisville, Ky.—The Breckenridge Asphalt Co. secured the contract for reconstructing Sixth-st., between Oak and Ormsby, with asphalt, for $7,011.50.

Milwaukee, Wis.—The Warren-Scharf Asphalt Paving company was awarded the contract for 14,432 square yards of asphalt paving at $2.30, $2.31 and $2.32 a square yard.

Chicago, Ill.—The commissioner of public works received ten bids, Aug. 21, for paving and resurfacing a number of streets. The bids were ordered tabulated.

Galesburg, Ill.—The contract for paving N. Cherry and North-sts. with brick was awarded Aug. 3 to Berry & Welch of Iowa City, Ia., at $1.18½a square yard.

Jamaica, N. Y.—The contract for macadamizing the Jamaica and Hempstead turnpike was awarded July 30 to De Witt C. Bowker, jr., of Brooklyn for $148,541.

Erie, Pa.—The contract for paving E. Sixth-st., from Parade to East-ave., was awarded Aug. 10 to J. M. Kuhn & Co. at $1.69 a square yard.

Monticello, Ind.—The contract for constructing a macadam road 12½ miles long was awarded to Hawkins, Curtis & Taber of Remington, Ind., for $22,201, Aug. 12.

Boston, Mass.—H. Gore & Co. have been awarded the contract for building a telford and macadam road on Huntington-ave., from Gainsborough-st. through Longwood, for $23,320.

Cortland, N. Y.—The Jamestown Construction Co., Jamestown, N. Y., secured the contract for paving Railroad-st. with brick, from the D., L. & W. depot to Main-st., for $18,500.

Toledo, O.—William McMahon was awarded the contract Aug. 13 for paving with Wassall block Michigan-st., from Walnut to LaGrange, and Oakwood-ave., from Lawrence-ave. to Bancroft-st.

Springfield, Mass.—The contract for sheet asphalt paving in Harrison-ave. has been awarded to the Southern New England Asphalt company, of Hartford, Conn., at $2.49 a square yard, ten year guarantee.

Crawfordsville, Ind.—The contract for brick paving was awarded Aug. 3 to Ira McConnell at $1.09 for standard block and $1,125 for Poston block. This city contemplates doing considerable paving next season.

Ft. Wayne, Ind.—Julius Remus was awarded the contract for paving the alley between Main and Columbia-sts., from Calhoun to Clinton, with Metropolitan brick on a six-inch foundation at $2.25 a lineal foot.

Morristown, N. J.—The contract for macadamizing Washington-st., from South-st. to Western-ave., and Park-place, from Speedwell-ave. to Washington-st., has been awarded to Osborn & Marcellus of Montclair for $2,699.74.

Toledo, O.—The Manufacturers' Railway company received bids Aug. 18 for paving forty-feet of the center of Water-st., from Locust to Oliver, 1,100 feet. F. E. Cole, Charles McKinney, H. P. Streicher and William McMahon were the bidders.

Syracuse, N. Y.—Oak-st., from James-st. to Highland-place, will be paved with sheets asphalt by the Empire Contracting Company for $5,945.50.

Atlanta, Ga.—Bids have been received for raising the grade of Edgewood avenue, from Piedmont avenue to Fort street. The estimated cost for the grade work proper is about $30,000, and for repairing the street and cross treet, about $7,000.

Fort Monroe, Va.—The contract for about 2,500 square yards of brick paving and for building a retaining wall was awarded to John Jacoby of Wilmington, Del., at $7.75 a cubic yard for sea wall, $2.10 a square yard for paving and $2 a square yard for granolithe walks.

Cambridge, Mass.—Bids have been received for 14,000 square yards of asphalt lining for the Payson Park reservoir as follows: Simpson Bros., 31½ cents a square yard; Mark Wilmarth, Boston, 95 cents; Alcatraz Asphalt Company, San Francisco, $1.11.

Tacoma, Wash.—The board of county commissioners awarded the contract for the construction of the Puyallup boulevard and Bay street to F. H. Goss for $2,587.33 and $2,718.67 respectively. The other bidders were Davie & Hilley and M. W. Dibble.

Annapolis, Md.—(Special.)—The Abbott-Gamble Contracting Company ,St. Louis, Mo., has been awarded the contract for paving all the approaches to the Annapolis Navy Yard with Mack fire clay block. The contract was awarded by the U. S. Navy Department.

Rochester, N. Y.—Whitmore, Rauber & Vicinus presented the lowest bid Aug. 18 for a Medina block pavement in S. St. Paul street, which was $17,850.44. The Warren-Scharf Asphalt Paving Company's bid, $13,122.85, was the lowest for curbs and walks in West avenue.

Lincoln, Ill.—The contracts for paving Tremont street, 7,553 square yards, and McLean street, 1,151 square yards, have been awarded to H. S. Pierce & Co. as follows: Paving, $1.09 a square yard; curbing, 43 cents a lineal foot; round corners, $2.50 each.

Cincinnati, O.—Brick paving contracts have been awarded as follows: Tower street, A. J. Henkle & Bro., $2,945.25; Clearwater street. A. J. Henkle & Bro., $3,031.85; Benham alley, J. A. Wherard, $1,800.70; L'Hommedieu alley, J. Evans, $5,556.01; Goose alley, T. Evans, $7,103.03.

Saginaw, Mich.—The contract for paving Genesee avenue, from Jones to Hoyt street, with asphalt, was awarded to the Barber Asphalt Paving Company, Aug. 14.

Jersey City, N. J.—The sidewalks of the Hudson boulevard will be paved with bluestone, class B, at a cost of $166,154. Jacob DuBois was awarded the contract for the Bayonne and Greenville turnpike at $48,810 and for section 2, from the Morris canal to the Jersey City line, for $74,875; section 3 was awarded to Julius Finerti for $42,464.

Albany, N. Y.—Paving contracts were awarded Aug. 17 as follows: Brick—First-st., from Hawk to Lark, T. Henry Dumary, $15,030.40; Second-st., from Ten Broeck to Knox, T. Henry Dumary, $25,728.30; St. Ann's-place, from Fourth-ave. to end of thoroughfare, Robert H. Strong, $1,159.

Youngstown, O.—Bids were received Aug. 10 for paving Wick-ave., between Wood and McGuffey-sts., from George J. Vetter, James B. Chambers, Davis & Caldwell, C. R. & S. H. DeGroodt, Ohio Stone and Paving Company, I. B. Finch and the Barber asphalt paving company. The bids were taken under advisement.

Milwaukee, Wis.—The Warren-Scharf Asphalt Paving Company was awarded the contract for 14,432 square yards of three-inch asphalt paving on seven inches of concrete at the following prices: Paving $2.30 and $2.32 a square yard, new curb 39 cents a lineal foot, protection curb 20 cents a lineal foot, old curb reset 10 cents a lineal foot.

Kansas City, Mo.—The Barber Asphalt Paving Company was awarded the contract Aug. 19 for paving Seventh-st., between Askew and Walrond-aves., with Trinidad asphalt at $2.15 a square yard. The bid of the Parker-Washington company was 10 cents higher than that of the Barber Asphalt Paving Company.

Waterbury, Conn.—Bids were received Aug. 5 for paving Bank-st. with brick, asphalt blocks or granite dimension blocks, the work amounting to 2,500 square wards of paving and six granite cross-walks. The lowest bid received was that of John A. Doolittle & Co. of New Haven, for Mack wire-cut brick, $2.34 a square yard.

New Haven, Conn.—The board of aldermen's resolution instructing the board of public works to proceed with the paving of Orange-st. with Sicilian rock asphalt, was concurred in Aug. 11 by the board of councilmen. The Boston Asphalt Company was awarded the contracts June 3 at $3.33. $3.01 and $3.05 a square yard.

Des Moines, Ia.—The lowest bids received Aug. 18 for grading were: E. North-st., O. P. Herrick, 11 29-100 cents; N. Second-st., H. V. King, 21 cents; alley between Crocker and School-sts., O. P. Herrick, 17.9 cents. For cement curbing on Twenty-fifth-st., from Cottage Grove-ave. to University-ave., Hugh Miller, 36½ cents.

La Grange, Ill.—John H. Esson, Chicago, was awarded the contract Aug. 3, in this city, for paving and curbing at the following bids: Brick—Galesburg No. 1 repressed, $1.38 a square yard; Streator standard, $1.30; Springfield repressed, $1.38; Bedford stone curbing, .385 cents a lienal foot; total cost, $3,145.

Chicago, Ill.—The Barber Asphalt Paving Company was awarded contracts Aug. 21 for asphalt paving as follows: Resurfacing Dearborn-st., from Chicago-ave. to Burton-place, $9,653.j6; resurfacing Warren-ave., from Ogden-ave. to Leavitt-st., $1,734.90; paving Evans-ave., from Sixty-third to Sixty-seventh-st., $21,599.50.

Chicago, Ill.—Contracts were awarded Aug. 6 for paving streets on the West and South Sides, by Commissioner of Public Works Downey, as follows: Cedar blocks—Congress Park-ave., R. F. Conway, $3,697.50; Sixty-third-st., Sackley & Paterson, $12,194.51; W. Twentieth-st., A. J. McBean & Co., $1,118.30; asphalt: Turner-ave., Barber Asphalt Paving Company, $10,285.80.

Fort Wayne, Ind.—Bids were received Aug. 7 for paving W. Jefferson street, from Broadway to Garden, as follows: C. E. Moellering & Co., Metropolitan block, $5.77 a lineal foot; Nelsonville, $5.65; Carrollton, $5.55. T. P. Empie, Metropolitan, $6.02; Mack, $6.12. Herman W. Tapp, Metropolitan, $6.27; Mack, $6.40 Jas. W. Wilding, Metropolitan, $5.88.

Jersey City, N. J.—Thomas Harrington presented the lowest bid Aug. 6 for about 22,000 square feet of granolithic cosmocrete pavement or its equivalent, 600 feet of sewer pipe, 8 catch basins, etc. The bid was $9,352. The Barber Asphalt Paving company was the lowest bidder for asphalt paving at $1.77½ a square foot and 25 cents a foot for curbing, but the bid was laid over.

Bridgeport, Conn.—The contract for asphalt paving was awarded Aug. 7 to the Standard Asphalt company of New York at $2.65 a square yard, five year guarantee. The Traction company has been relieved of the necessity of using Scoria blocks on either side of the rails and the asphalt will be laid flush with each outside rail, with vitrified brick inside the tracks.

Detrot, Mich.—The contract for widening Concord avenue, from Jefferson to St. Paul, was awarded to the Talbot Paving Co., for $2,585.13, and the contract for paving State street, from Griswold to Cass street, was awarded to John McLaughlin on his bid for brick paving, at $4,363.91. The Barber Asphat Paving Co. was the lowest bidder for asphalt on this street at $6,333.59.

Detroit, Mich—The lowest bids received Aug. 10 for cedar block paving on seven street were as follows: Charlotte avenue, Michigan stone and supply company, $2,633.08; Champlain street, Wm. Lappin, $4,347.35; Garfield avenue, Michigan stone and supply company, $7,537.15; Helen avenue, Currie & Conn, $12,763.99; Tenth street, Michigan stone and supply company, $5,530.09; Wabash avenue, Lennane Bros., $6,222.73.

Grand Forks, N. D.—The contract for two miles of cedar block paveing was awarded July 4 to P. McDonnell of Duluth, Minn., at the following prices: Paving, 9 cents a square yard; granite curbing, 90 cents a lineal foot; sandstone curbing, 70 cents a lineal foot; wood curbing, 30 cents a lineal foot. The other bidders were: A. and D. Sang, Duluth; Osgood & Reilly, Fargo; O'Connell & Carroll, and James Dinnie, Grank Forks.

Monmouth, Ill.—The contract for paving North A street, from Broadway to Archer avenue, was awarded to Brodin & Dungan at the following prices: Excavating 300 yards, 15 cents a square yard; brick paving 1,400 yards, 92 cents a square yard; curbing 800 feet, 43 cents a lineal foot. The only other bidder was Ed Walsh & Co., Davenport, Ia., who bid 15 cents for excavating, 98 cents for paving and 43 cents for curbing.

Washington, D. C.—Bids were received Aug. 20 for asphalt paving as follows: Barber Asphalt Paving Company, 6-inch base, $1.63 a square yard; 8-inch, $1.83; resurfacing over cobble, $1.10; furnishing and spreading binder, $6.90 a square yard. Bermudez Asphalt Paving Company, 6-inch base, $1.75 a square yard; 8-inch, $1.95; resurfacing over cobble, 53 cents a square yard; furnishing and spreading binder, $12.50 a square yard. Washington Brick and Tile Company, 6-inch base, $1.77 a square yard; 8-inch base, $2.

Philadelphia, Pa.—Bids were received Aug. 12 for work in the Highway Bureau for which $100,000 is available. The contract for paving Dauphin street, from Twenty-fifth to Sedgley avenue, with Belgian blocks, was awarded to Owen McKenna. The Pennsylvania Asphalt Paving Company and the Vulcanite Paving company were the only bidders for asphalt paving. For brick paving P. McManus, Frank McCullough, Thomas Cunningham, Mack Paving Company and D. McMahon were the bidders.

Arcola, Ill.—The bids received Aug. 21 for paving E. Main street with brick were as follows: J. G. Shay, Danville, Ill., Danville brick, $1.40 a square yard; Berea curbing, 45 cents a lineal foot; Contractor Mayfield, Springfield, Ill., Clinton repressed brick, $1.44 a square yard; Berea curbing, 45 cents a lineal foot; Lough, Crews, & Allison, Veedersburg brick, $1.46 a square yard; Clinton repressed brick, $1.48 a square yard; Bedford stone curbing, 31 cents a lineal foot; Cleveland stone, 36½ cents a lineal foot.

Beloit, Wis.—The contract for crushed stone and brick paving was awarded to A. E. Rutledge &Co. of Rockford, Ill., for $5,604. The residents of the city are dissatisfied regarding the material to be used. Some favored wood block, some brick and some macadam. The decision of the council was to pave the center of the street with crushed stone and the gutters with brick. It is probable that the people who want block paving will endeavor to enjoin the city from proceeding with the work.

Jersey City, N. J.—Bids were received recently for laying the sidewalk on the boulevard. The lowest bidders were: Section No. 1, Class A, Hudson County Paving Company, $45,798.21; Class B, J. B. Dubois, $49,815.65; artificial stone, E. Nash Company, $45,971.10. Section No. 2, Class, Hudson County Paving Company, $68,-913.98; Class B, J. Dubois, $74,874.57; artificial stone, Chert Company, $68,624.27. Section No. 3, Class A and B, J. Finesti, $40,-044 and $42,464; artificial stone, Wilson & Baillia Company, $41,385.

Kansas City, Mo.—The Parker-Washington Company was awarded the contract Aug. 4 for paving Washington street, from Tenth to Thirteenth street, with Trinidad lake asphalt at $2 a square yard, and the Barber Asphalt Paving company was awarded the contract for Holmes street, from Eighth to Tweifth, at $2.12 a square yard. Messrs. David and F. P. McCormick are the Kansas City representatives of the Parker-Washington Company.

New York, N. Y.—The contract for paving Fifth avenue, from Ninth to Fifty-ninth street, with asphalt, was awarded Aug. 8 to the California Asphalt Paving Company at $3.85 a square yard for asphalt, $3 a cubic foot for the concrete and 65 cents a lineal foot for the curbings. The Fruin-Bambrick Construction Company bid $3.90, $4.75 and 60 cents; Barber Asphalt Paving Company, $3.59, $4.50, 60 cents; Silician Asphalt Company, $3.91, $4.46, 65 cents; Warren-Scharf Asphalt Paving Company, $3.81, $4.65, 65 cents.

Evansville, Ind.—Paving contracts were awarded, Aug. 16, as follows: Second-ave., Eichel, Arnold & Co., Iron and Sciota block, 48 cents a square yard; resetting curb, 20 cents a lineal foot; new curbing, 50 cents a lineal foot; corners, $1. Bedford, Weikel & Nugent, Alleys, Lant & Morris brick, $1.16 a square yard; between Third and Fourth-sts., $1.09¼; between Franklin and Michigan-sts., $1.15½; between Campbell and Emmett-sts., $1.14½; between Franklin and Michigan-sts., from Twelfth to St. Joseph-aves., $1.18¾.

Detroit, Mich.—The bids received for cedar block paving, July 31, are said to be the lowest ever received in the city. The conrtacts were awarded as follows: Canfield-ave., from Third to Fourth-aves., Merdian & Co., $1,101.21; Van Dyke-ave., from Jefferson to Champlain-st., William Lappin, $3,195.84; Prenits-ave., from Third to Fourth-aves., Merdian & Co., $1,094.47; Alexandrine-ave., from Third to Fourth-aves., J. H. Talbot & Co., $1,087.83; Cherry-st., from Trumbull-ave. to Twelfth-st., Michigan and Stone Supply Co., $5,292.69; Hudson-ave., from Grand River to Vinewood-ave., $13,93.09; Elmwood-ave., from Clinton to Waterloo-st., J. H. Talbot, $8,-277.81.

St. Louis, Mo.—The lowest bids received Aug. 7 for street work were: Grading—Portion of Delmar boulevard, Allen & Vieths, $2,515.20; Evans-ave., Thomas Whelan, $644; Cherokee-st., Michael Herrick, $312.80; Cook-ave., Tim Molony, $494; one portion of Page boulevard, E. C. Morrison, and Allen & Vieths, $1,000 (tie); second portion of Page boulevard, Thomas Whelan and Allen & Vieths, $495 (tie); Pendleton-ave., Wade Bros. Construction company, $810. Telford paving—Evans-ave., St. Louis Quarry and Construction company, $810; Delmar boulevard, Fruin & Heman, $22,-631.50; Cherokee-st., Hoffman & Co., $1,-940.40. Brick paving—Cook-ave., Allen & Vieths, $8,564.60; one portion of Page boulevard, C. M. Conrad, $17,112.40; Pendleton-ave., Allen & Vieths, $10,378.24.

CONTRACTS TO BE LET.

Buffalo, N. Y.—Bids were opened Aug. 17 for paving two sections of Elmwood-ave., between Forest-ave. and the bridge over Scajaquada creek, and between Amherst-st. and Hertel-ave. The proposed paving is a move towards bringing into use the new bridge over the creek, which was finished several months ago. Bids were called for both macadam and asphalt paving. For the sections be-

tween Amherst-st. and Hertel-ave. the Standard Paving Company submitted the lowest bid for macadamizing, $16,000. The bids received for asphalt were: Standard Paving Company, $31,830; German Rock Company, $38,900; Barber Asphalt Paving Company, $30,982 on streets without car tracks, and $32,821 on street with car tracks. Elmwood-ave., between Forest-ave., and bridge, macadamizing: Barber Asphalt Paving Company, $11,022; asphalt, German Rock Company, $24,444; Barber Asphalt Paving Company, $19,733 on streets without car tracks, and $20,889 on streets with car tracks.

Indianapolis, Ind.—The contract for paving with asphalt the first alley east of Pennsylvania-st., from Massachusetts-ave. to New York-st., was awarded to the Western Paving and Supply Company at $1.82 a lineal foot each side. Contracts were awarded Aug. 24, as follows: Grading and graveling roadway and sidewalks of Twenty-fifth-st., from Meridian to Pennsylvania, McCray & Co., $1.23 a lineal foot. Cement sidewalks: Missouri-st., from South to Merrill, W. H. Peters, 97 cents; Illinois-st., from Thirty-third to Thirty-seventh, W. H. Peters, 84 cents. Brick sidewalks: State-ave., from Orange to Cypress, C. M. Kirkpatrick, 40 cents. Graveling roadway and paving sidewalks with cement: Rural-st., from Washington to Ohio, Henry C. Eickman, $1.62. The Western Paving and Supply company was awarded the contract, also, Aug. 7, for paving with asphalt an alley in the rear of fire headquarters at $1.82 a lineal foot each side. The Indiana Bermudez company bid $1.97 on this contract.

SEWERS.

CONTEMPLATED WORK.

Manchester, N. H.—A sewer in River road is proposed.

Mackinac Island, Mich.—A sewerage system is contemplated.

Youngstown, O.—A main sewer on the South Side is contemplated.

Lead, S. D.—A sewerage system is contemplated. Andrew Rosewater, Omaha, Engineer; L. P. Jenkins, Mayor.

South Bethlehem, Pa.—An expenditure of $100,000 for sewers is proposed.

Jamestown, N. Y.—A sewerage filtration system in Ellicott has been recommended.

Hamburg, N. Y.—The question of constructing a trunk sewer will be voted on.

Deering, Me.—The Oak street sewer order has been passed by the city council.

Cedar Falls, Ia.—A proposed sewerage system is being considered by the council.

Waterbury, Conn.—A storm water drainage system is recommended at a cost of $100,000.

Covington, Ky.—A sewer is proposed on Thirteenth street, east from Russell street.

Youngstown, Pa.—A sewerage system, estimated cost about $100,000, is contemplated.

Mount Carmel, Pa.—Surveys have been made for the proposed drainage of this city.

Cincinnati, O.—The B. of A. has decided to construct a trunk sewer on Mt. Adam soon.

Lawrence, Mass.—The extension of the sewerage system has been recommended by the Mayor.

Dixon, Ill.—A sewer is contemplated on Peoria avenue, between First and Second streets.

London, Ont.—The free-holders will vote Sept. 2 on the question of a new sewerage system.

Springfield, O.—Resolutions were adopted Aug. 13 for constructing new 30 and 24-inch sewers.

Sistersville, W. Va.—Sewer construction is contemplated; estimated cost, $8,000. J. P. Sweeney, Clerk.

Middletown, Conn.—A brick and pipe sewer, 1,718 feet long, in North Main street, will be constructed.

Chappaqua, N. Y.—An entirely new system of drainage is contemplated for the Chappaqua Mountain Institute.

Kingston, N. Y.—Sewers will be constructed in portions of Wurts and Spring streets. H. E. Wieber, Mayor.

Trenton, N. J.—Sewers are contemplated for Church, Warren and South Broad streets, and Kersey and Midwood alleys.

Johnstown, N. Y.—A report has been submitted on the proposed sewage filtration plant. M. S. Northrup, Chairman Committee.

Sausalito, Cal.—An election will be held Oct. 1 to vote on the issue of $20,000 of bonds for a sewerage system.

Decatur, Ind.—An ordinance was passed Aug. 18 for a sewer in the alley between First and Second streets to the river.

New Britain, Conn.—It is now improbable that work will be commenced this year on the proposed 3,800 feet of 30x20-inch brick sewer.

Savannah, Ga.—The estimated cost of the proposed drainage system is about $120,000. A report will soon be made regarding the system.

Baltimore, Md.—The ordinance for a sewer in Charles street, between Twenty-third and Huntington avenue, was signed by Mayor Hooper, Aug. 5.

Holyoke, Mass.—The question of rebuilding the sewer in the alley between Bridge and Summer streets is being considered by the board of health.

Waukesha, Wis.—The common council has decided to issue $3,000 of 5 per cent. bonds with which to complete the sewerage system. J. M. Kerr, City Clerk.

Rochester, N. Y.—The West avenue sewer, from Reynolds to Canal street, will be enlarged from 2x2½ feet, its present size, to 3½ feet in diameter.

Brooklyn, N. Y.—The sewers in the Twenty-sixth ward are to be repaired at a cost not to exceed $12,000. The whole system has been constructed within the last five years at a cost of more than $1,000,000. The work will be done under the direction of Chief Engineer Milne.

Mason City, Ia.—The council has decided to complete the Willow Creek sewer, and an ordinance providing the required specifications is about ready for publication.

Decatur, Ill.—(Special.)—A. D. Thompson, city engineer at Peoria, has been engaged by the city as consulting engineer in the preparation of plans for a sewerage system.

Janesville, O.—Commissioner Greiner and County Surveyor Dunn advise that the tunnel of the present Chap's run sewer be enlarged so as to increase its capacity one-third.

Kansas City, Mo.—The South Side Improvement Club contemplates gas, water, sewerage and sidewalk improvements. Albert O. T. Pennington, Daniel B. Henderson and Ernest R. Sweeney interested.

Depew, N. Y.—The plans for the sewerage system have been approved by the state board of health, and are now awaiting the result of a vote that will be taken as to whether or not part of the system will be built.

Geneva, O.—(Special.)—C. E. Barnum says the town would like to make arrangements with some capable engineer to look it over and advise regarding a good system of sewerage and water works that the town can afford.

Harrison, N. J.—A petition has been presented to the common council from residents in the Third and Fourth wards, asking for a sewer through Davis, Harrison and Ogden avenues, to the Passaic river; estimated cost, $80,000.

Elizabeth, N. J.—The plans of Francis Collingwood, city engineer, New York City, provide for a large trunk sewer at least 10 feet in diameter, to run under Elizabeth river, collect the refuse from the city sewers and discharge it into the sound. The estimated cost, including a pumping station, is $112,000.

Dayton, O.—The committee on parks and levees has been authorized to employ the most competent and expert engineers possible to act in conjunction with the city engineer in examining into the proposed extension, straightening, and strengthening of certain parts of the levees along the Great Miami river, Mad river and Wolf creek. J. A. Robert.

Hartford, Conn.—The members of the board of sewer commissioners are endeavoring to devise some method whereby the city sewage can be disposed of in some manner different from that now in use. A recent examination was made of a system of aerial filtration, but the commissioners are of the opinion that the system is too complex and expensive.

Indianapolis, Ind.—Plans have been undertaken by the state board of health for furnishing better sewerage systems for the state institutions. The first institution to be supplied with better sewerage will be the Central Hospital for the Insane, in this city, which has 2,000 inmates. Dr. J. N. Hurty's plan is to prepare sewage beds and then convert the refuse matter into fertilizer.

Indianapolis, Ind.—The residents in the northeast part of the city are urging the board of public works to take action for the construction of a sewer in Bell street. A local sewer, with branches, will be built in Ketcham street, from Merrill to Sinker. The city engineer has been instructed to prepare papers for a sewer in Pratt street, from Senate to Capitol avenues.

Minneapolis, Minn.—Investigations have been made into the sewerage system of Nicollet Island, which was reported in a deplorable condition, but as far as the work of investigation has progressed both the sewerage and the sanitary conditions of the houses are in very good condition, with but two or three exceptions. Plans are being prepared for sewering the remainder of Nicollet Island. Dr. Avery, Commissioner of Health.

Newark, N. J.—The engineers of the Passaic Valley Sewerage Commission have begun experimenting with the currents of the lower Newark Bay to determine a point where sewage can be dumped without causing offense to dwellers along the shore. Several hundred sealed bottles will be set adrift at various points containing data as to where they were set adrift. These bottles will be picked up in several days after they are committed to the waves, and that will show where the various currents and tides would be likely to carry sewage. The commission may visit Milwaukee and Cleveland during this fall.

CONTRACTS TO BE LET.

Fargo, N. D.—Bids will be received until Sept. 14 for an extension of the Seventh street sewer. City Auditor.

LaCrosse, Wis.—Sealed proposals will be received until Sept. 1 for constructing a 12-inch circular pipe sewer, with appurtenances, in Fifth street, between Division and Market. Bond, $240. S. F. Nice, Mem. B. P. W.

Bluffton, Ind.—(Special.)—Sealed proposals will be received until Sept. 5 for the construction of a complete sanitary sewer system, including flush basins, manholes and lantern holes. Certified check, $3,000. John Miller, Cy. Clk.

Elkhart, Ind.—Bids will be received until Sept. 2 for the construction of a sewer in Jefferson and Harrison streets. Certified check, $100 each. Kit McKean, Cy. Clk.

Philadelphia, Pa.—Bids are invited until Sept. 1 for constructing branch sewers and an intercepting sewer in connection with the Pennsylvania avenue subway. Thomas M. Thompson, Dir. Pub. Wks.

Richmond, Ind.—Sealed proposals will be received until Sept. 4 for a sewer in the alley between Twelfth and Thirteenth streets, from S. B. to S. C. street. Bond, $1,000. Joseph H. Winder, Clk. B. P. I.

Cleveland, O.—Sealed proposals will be received until Sept. 17 for the construction of a sewer in Harvard street, between Jones avenue and Broadway. Certified check, $1,000. D. E. Wright, Dir. Pub. Wks.

CONTRACTS AWARDED.

Troy, N. Y.—Robert I. Gleason was awarded the contract for the Mill street sewer for $21,400.

Detroit, Mich.—John Wagner presented the lowest bid, $18,842, for constructing 2,530 feet of 56-inch sewer in Twenty-fourth street.

Cincinnati, O.—Wilson & Strack secured the contract, Aug. 11, for the new sewer in Pullen and Beechwood avenues, Cumminsville. Estimated cost, $50,000.

Providence, R. I.—The lowest bid received Aug. 3 for constructing sewers in Pleasant Valley Division was that of Fred E. Shaw of the city, which was $31,347.

Hayward, Wis.—The contract for constructing a sewerage system and for paving was awarded to the Winóna Construction company, Winona, Minn., for about $20,000.

Hinsdale, Ill.—C. & T. Iglehart were awarded the contracts for sewers, Aug. 11, as follows: Hickory street, $1.47 a lineal foot; Elm street, 92 cents; Pine street, 95 cents.

Kansas City, Mo.—The contract for a sewer from Fourteenth street and Cleveland avenue to Ninth street and Fairview avenue, was awarded, Aug. 5, to Wm. Moran for $5,992. It will connect the Gooseneck creek sewer at Ninth street and Fairview avenue.

St. Louis, Mo.—Bids were received for sewer construction, Aug. 7, and contracts awarded as follows: Lyons Construction Company, three contracts, $8,138.09, $5,122.65, $4,402.10 each; John Hussey, one, $8,355.51; James Martin, one, $1,665.46; S. B. Kendall, one, $12,658.45.

Jackson, Minn.—(Special.)—F. E. Stanley, construction engineer, says the contract for the construction of 1,410 feet of 10-inch and 250 feet of 8-inch sewers was awarded to John McCall of Mankato, at the following prices: 6 manholes, $28 each; 10-inch sewer, 47 cents a lineal foot; 8-inch sewer, 37 cents a lineal foot.

WATER-WORKS.

CONTEMPLATED WORK.

Parkersburg, O.—A filtration system is contemplated.

St. Petersburg, Fla.—Water works and electric lights are contemplated.

Monrovia, Cal.—The construction of extensive reservoirs is contemplated.

Saginaw, Mich.—A new intake for the East Side is contemplated by the water board.

Windsor, Ont.—About $12,000 will be expended in enlarging the city water mains.

Mohawk, N. Y.—A one-million-gallon compound steam duplex pump will be put in.

Oskaloosa, Ia.—The Water Works Company contemplates constructing a large reservoir filter.

DeKalb, Ill.—The city council contemplates extending the water works system at a cost of $30,000.

Lynchburg, Va.—The superintendent of the water works has recommended the purchase of a new pump.

Woonsocket, R. I.—An appropriation of $5,500 for extensions has been granted the water commissioners.

Westwood, N. J.—C. S. De Baun of the water works contemplates building a reservoir of about three acres.

Long Beach, Cal.—The Alamitos Beech Water Company will extend its mains and enlarge and improve its reservoirs.

Procter, Vt.—A resolution was adopted, Aug. 7, to spend $50,000 for a water works plant and a sewerage system.

White Sulphur Springs, Mont.—The city council contemplates having engineers make surveys and plans for water works.

Braddock, Pa.—The construction of a filtration plant, with a capacity of 7,000 gallons a day, has been decided upon.

Minonk, Ill.—The council has decided to build a new tower and tank for the water works system. Plans and specifications are wanted.

Millers Falls, Mass.—Preliminary surveys are to be made for the proposed new water works system. No contracts have yet been awarded.

Geneva, N. Y.—Emil Kuichling and S. G. Gano have been engaged as engineers for the erection of the new water works plant.

The question of water works has been favorably voted on at the following places: Stockton, Ill.; Plymouth, Ill.; Chagrin Falls, O.

New Milford, Conn.—The feasibility of constructing an additional reservoir for the water company is being considered. C. H. Booth, president of committee.

Palestine, Tex.—The council has resolved to issue $100,000 in bonds with which to put in a municipal water plant, and the mayor will advertise for bids soon.

Grove City, Pa.—The Grove City Water Company has been formed with a charter to lay their lines along the main streets of this city. Dr. I. C. Kettler is president.

Rockford, Ill.—The plan proposed by D. W. Mead for a water works system has been recommended to the council by the water committee. Mr. Mead guarantees to deliver into the pumping pit five million gallons daily, or nearly two millions daily more than the city is using at present; estimated cost, $49,500.

CONTRACTS AWARDED.

Phelps, N. Y.—The contract for finishing the water works system has been awarded to Herbert Edson for $14,000.

Norwalk, O.—The Toledo Construction Company was awarded the contract for the construction of two reservoirs at the side of the new water works for $43,292.80.

Skaneateles, N. Y.—The lump bid of John Marsden, Utica, N. Y., for constructing water works, and the net bid of M. B. Birdseye, Fayetteville, N. Y., were the lowest received Aug. 13 for constructing the water works. M. B. Birdseye's bid was $21,020, and John Marsden's $29,000. The contract has not yet been awarded.

Walkerton, Ind.—Contracts for the water works were awarded Aug. 10 as follows: Tower, Flint, Walling Manufacturing Company, Kendallville, $1,794; hydrants, gate valves, etc., Bourbon Copper and Brass Works, Cincinnati, about $500; engine house and pump-room, W. L. Walters, city, $394.50; laying pipe, setting hydrants and putting in water gates, Chas. Sheatsley and Albert Peed, $855. All bids for engine and boiler were refused and they will be purchased later.

BRIDGES.

Youngstown, O.—The erection of four new bridges is contemplated.

Woonsocket, R. I.—Plans have been ordered for a two span steel bridge.

Salem, Mass.—An iron draw bridge, 40 ft. long, is contemplated by the council.

New York, N. Y.—Contracts for work on the new East river bridge will soon be let.

Greensburg, Pa.—An ordinance has been passed for a bridge over Jack's run.

Rochester, N. Y.—Plans are being prepared for a new bridge over Red creek.

Frankfort, Ind.—The iron bridge on the Lafayette road was carried away by floods.

Dayton, O.—Three bridges over Dry run were washed away. Two will be replaced.

Holland, Wis.—Bids are invited until Sept. 15 for constructing a bridge. Town clerk.

Milo, Ia.—A petition has been circulated for a bridge in the south part of town.

Youngstown, O.—The people of the south side have petitioned for three overhead bridges.

Spearfish, S. D.—Plans for a bridge across the Spearfish river at J street are being considered.

Madison, Neb.—Bids will be received until Sept. 2 for building several bridges. E. G. Heilman.

Alma, Neb.—An iron bridge will be built over the Republican river at Horn's Ford. Samuel L. Roberts, City Clerk.

White Sulphur Springs, Mont.—Bids will be received until Sept. 7, for constructing a bridge. C. W. Hall, County Clerk.

Niagara Falls, N. Y.—A new bridge having a span of 840 feet, will be built to replace the old suspension bridge.

Easton, Pa.—The Wrought Iron Bridge Company, Canton, O., was awarded the contract for a highway bridge for $4,150.

Beardstown, Ill.—A steel wagon bridge is proposed across the Illinois river to replace the one that is there now.

Gowanda, N. Y.—Press reports state that a new steel bridge will be erected on the plan of the one that gave way Aug. 5.

Lancaster, Pa.—Bids will be received until Sept. 5 for constructing a fifty-foot iron bridge. W. W. Griest, County Clerk.

Olivet, S. D.—Bids will be received until Sept. 7 for building a bridge across the James river. Paul Dekkar, County Auditor.

Newton, O.—The contract for building the new bridge over the Miami river was awarded to C. H. Glandorf for $16,776.66.

South Manchester, Conn.—Two new stone arch bridges, one over Bigelow brook and one at S. Main street, are contemplated.

Middleburg, Pa.—The Wrought Iron Bridge Company, Canton, O., was awarded the contract for the Middleburg and Fisher's Mill bridge at $1,900.

Watertown, S. D.—The county commissioners have voted to build a bridge over the Sioux river twenty-eight feet long, and with an eighteen-foot roadway.

Salem, S. D.—Bids will be received until Sept. 7 for constructing a stone bridge across the East Vermillion river. M. McCarty, County Auditor.

Baltimore, Md.—A petition has been presented to the county commissioners for a new bridge over Warren race to take place of a wooden one.

Redwood City, Cal.—Bids are asked until Sept. 7 for constructing a bridge over Dickerman creek. H. B. Adair, supervisor, Pescadero, Cal.

Hillsboro, N. D.—Bids are asked until Sept. 8 for constructing seven county bridges, to cost from $4,000 to $7,000 each. George O. Stomner, County Auditor.

Choteau, Mont.—Bids will be received until Sept. 5 for constructing a bridge over Dupuyer creek, near Dupuyer, where plans may be seen. J. Wamsley, County Clerk.

Des Moines, Ia.—John Killmer was awarded the contract for Fifth-st. bridge for $19,100. Contract for abutments was awarded to John Lock at $12,214.64.

Butler, Pa.—The court has approved the recommendation, by the receivers, for a new bridge over Sonnoquenessing creek at Marshall fording, Farwood township.

Gettysburg, Pa.—Sealed proposals will be received until Sept. 2 for a wooden, iron or steel bridge across the Bermudian creek in Huntington township.

Indianapolis, Ind.—A new bridge is recommended by Street Commissioner Herpick to cross the canal at West street, the old one being in a bad condition.

Goshen, Ind.—The county commissioners have granted the petition of the common council for two new bridges across the Elkhart river and at East Lincoln avenue across Rock run.

St. Paul Minn.—A resolution has been passed directing the city engineer to prepare plans for constructing a bridge on Raymond avenue, at St. Anthony park, over the railway tracks.

Milwaukee, Wis.—A resolution was passed declaring that the construction of the Grand avenue viaduct is a public necessity and calling on the legislature for the passage of a law authorizing the improvement.

Sparta, Wis.—A press report says the new bridge over the La Crosse river at Railroad street will answer well enough for three or four years, but a steel bridge will have to take its place when it has served its time.

White Hall, Ill.—At a joint meeting of the highway commissioners of White Hall and Carrollton townships Aug. 3 it was decided to build a steel bridge over Apple creek at Belltown, about four miles south of this place.

Menasha, Wis.—Sealed proposals will be received until Sept. 8 for constructing an all iron bridge over the Fox river. Each bidder is to furnish his own plans and specifications for the superstructure and also for the substructure. Certified check, 5 per cent. W. W. Reed, city engineer, will furnish profile of the crossing with surroundings, etc.

PARKS.

Schenectady, N. Y.—The purchase of ground for a public park is contemplated.

Waukesha, Wis.—Extensive improvements are contemplated for Horeb Spring park next year.

Edna, Tex.—The citizens have raised a fund to improve, as a park, the railroad reservation between the depot and business houses.

Camden, N. J.—An ordinance authorizing the borrowing of the sum of $75,000 for the purchase of land for a public park has been passed, to take effect immediately.

Bellevue, Pa.—By the will of Jane Bayne Teece this borough is the recipient of a park, ground for a library and $10,000 to improve and maintain the institution.

Helena, Ark.—A number of citizens are agitating the question of establishing a public park and the government grounds around the Custom House are suggested as a suitable place for one.

Manchester, N. H.—A petition was presented to the committee on parks and commons recently for a park to be located and to be bounded by South Main, Second, Schiller, Wheelock and Hale streets, and 800 by 500 feet in size.

Winona, Minn.—Mayor A. B. Youmans has appointed a new park board consisting of W. H. Yale, C. F. Schroth, D. Sinclair, H. W. Lambertine and M. G. Norton. The best method of establishing a park system will be taken up by the board.

Menominee, Mich.—The proposition made by the City Council that the County Board be asked to donate the use of the Court House site for a city park has been unanimously approved by the board. Immediate action will be taken in the matter.

Newark, N. J.—A public park has been tendered this city by Paul Buchanan. Mr. Buchanan will, if the city accepts the park, have the curbing and flagging put in good order at his own expense before the actual transfer of the ground is made.

Cleveland, O.—Another magnificent donation of lands for park purposes has been made to this city by Patrick Calhoun. The land consists of 200 feet fronting on Euclid avenue and known as Cedar Glen. Its worth is estimated at $170,000.

Chattanooga, Tenn.—The city park commission will probably be delayed in its project of making a public park of Broad street, from Seventh street to the river, owing to the board of public works not having sufficient funds at its disposal to grade the street.

Kansas City, Kas.—The members of the park commission visited Shawnee Park Aug. 18 for the purpose of making a thorough examination of the grounds and surroundings and for the purpose of ascertaining what improvements will be necessary to put the park in first-class condition. The city has also acquired Chelsea park.

Cincinnati, O.—In the annual report of the park department Superintendent Warder suggests that the city ought to purchase a park not less than 3,000 acres in size in some locality convenient to the city by railroad. He thinks that the city should rent open lots in the thickly populated portion of the city and convert them into small parks for those children whose parents cannot let them go to more distant places.

Brooklyn, N. Y.—The new Dyker Beach Park is said to be one of the pleasantest in the whole chain of beautiful ground this city has acquired, and will convert into a delightful resort what is now a lonely and unsightly marsh. The new park will have some features not common to others. One will be a lagoon where swan boats and launches can be operated in safety and another a bathing pavilion. A large play ground, where base ball, golf and tennis can be played, and where children may romp unrestrained, will be other features of this park.

TOO LATE FOR CLASSIFICATION.

Alton, Ill.—The contract for paving the public square will be let Sept. 7.

Macomb, Ill.—The paving committee has been authorized to make contracts for paving the public square.

San Rafael, Cal.—Bids are asked until Sept. 7 for grading in Fourth street. John W. Bustin, City Clerk.

Jamaica, L. I.—Bids are invited until Sept. 10 for about seven miles of macadam roads. John R. McLaughlin, Engineer.

Mansfield, O.—Sealed proposals will be received until Sept. 5 for improving W. Third and Hanna streets. F. M. Remy, City Clerk.

Huntingburg, Ind.— Sealed proposals will be received until Sept. 21 for graveling repairing and refilling sundry strees. James Murray, City Clerk.

Paterson, N. J.—Bids are asked until Sept. 7 for resurfacing the Goodwinville turnpike, between this city and the Bergen county line. R. E. Doremus, Chairman Committee.

Kansas City, Mo.—The board of park and boulevard comimesioners has decided to advertise for bids for paving a small portion of Independence boulevard on Scarritt avenue.

Choteau, Mont.—Bids will be received until Sept. 5 for constructing turnpike road on section line between sections 3 and 10. G. O. Miller, Chairman, board Supervisors.

South Bend, Ind.—Sealed proposals will be received until Sept. 14 for curbing with cement the sidewalks on both sides of Lafayette street, from Sample to Garst. L. A. Hull, City Clerk.

Greenwich, O.—Sealed proposals will be received until Sept. 2 for constructing a water works system. C. L. Otterbacher, W. W. Trustee.

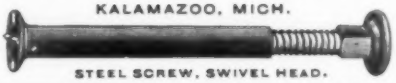
North Tonawanda, N. Y.—Bids are invited until Sept. 4 for laying water pipe, etc. Certified check, $15,000. E. C. McDonald, Pres. Bd. W. Coms.

Bluffton, Ind.—(Special.)—Sealed proposals will be received until Sept. 14, for the construction of a storm water sewer system, including flush basins, manholes and lantern holes upon the streets, alleys and grounds of said city. Certified check, $3,000. John Miller, City Clerk.

Albany, N. Y.—In speaking of the paving in this city, City Engineer Andrews said: "The vitrified brick pavement is proving entirely successful. Instead of chipping, the bricks round at the edges and become better with use. The cement used holds them together so strongly that to take up one brick it is necessary to remove several others. The cement method is better than the tar method employed in some cities, and gives more satisfaction."

Pittsburg, Pa.—The contract for about 40,000 square yards of asphalt paving was awarded to Booth & Flinn, Aug. 10, at $1.85 a square yard. The Pennsylvania Asphalt Company secured the contracts for about 18,000 square yards of asphalt paving at $1.87 and $1.95 a square yard. Sycamore-st. will be paved with block stone by Booth & Flinn at 80 cents for grading and $1.62 for paving. The contract for constructing the Grant boulevard was awarded on the same date to W. E. Howley & Co., and Beechwood-ave. to Thomas McNally.

Kalamazoo Foundry and Machine Co.
KALAMAZOO, MICH.



ADJUSTABLE TRENCHING BRACE.
The SIMPLEST, STRONGEST, MOST DURABLE, and CHEAPEST Sewer Brace on the Market.

Rue's Extension Sewer Brace
PATENTED JULY 23, 1895.
The only Brace made that has its screws covered and protected from dirt and injury.
Manufactured and for Sale by ROSS RUE, Alliance, Ohio.

CAMPBELL BROS.
SEWER BUILDERS
DEALERS IN
SEWER PIPE, FIRE BRICK,
FIRE CLAY, TERRA COTTA WARE,
IMPORTED AND AMERICAN
CEMENTS,
LIME, PLASTER, HAIR, ETC.
Pennington and Nickel Plate R. R.
CLEVELAND, OHIO.

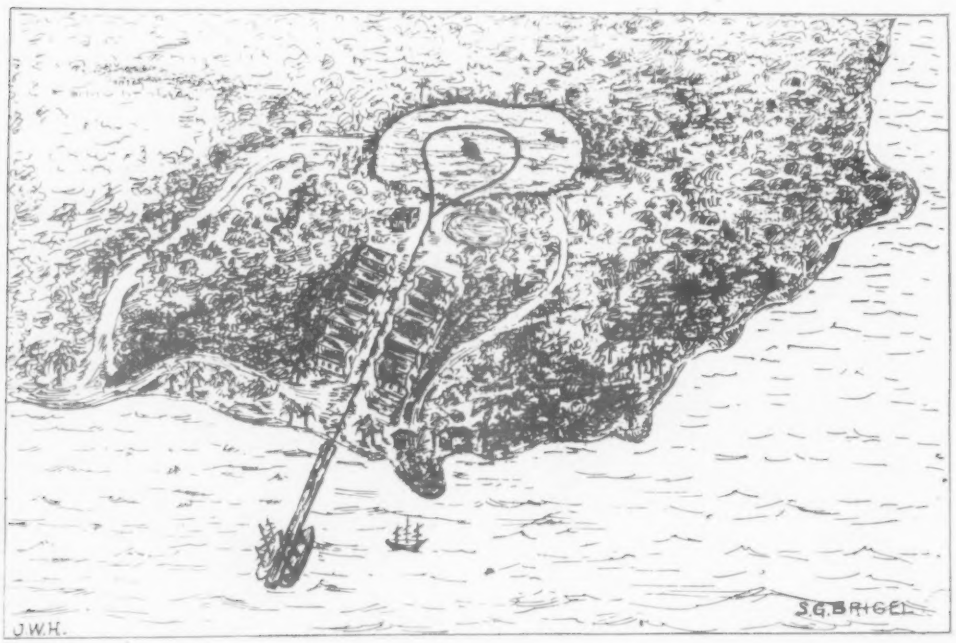
"THERE ARE OTHERS,"
BUT OUR
EXTENSIBLE SEWER BRACE
Is Better than the Best of them.

DUNN MFG. CO., Lim.
Penn Building. PITTSBURG, PA.
Write for Catalogue.

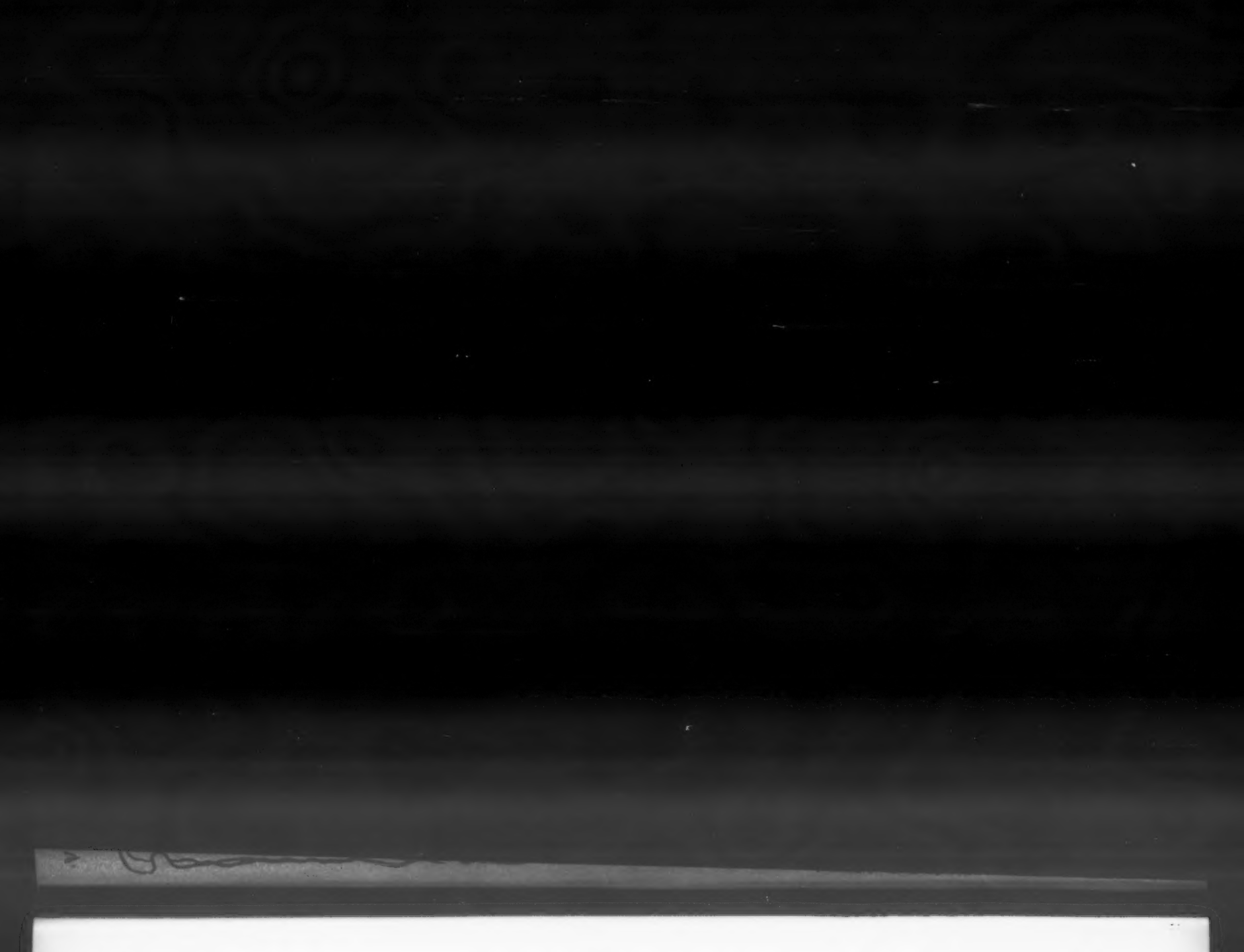
THE TRINIDAD ASPHALT LAKE

THE RELIABLE SOURCE OF SUPPLY FOR ALL SUCCESSFUL ASPHALT PAVING COMPANIES.

This lake of natural mineral pitch, known as the Trinidad Asphalt Lake, has been so often described by authors, travelers and scientists, that it is not necessary to more than call attention to the accompanying bird's-eye view, which is of that part of the Island of Trinidad near Point Boyer. The picture clearly shows the location of the immense depression filled with asphalt. It is called a lake for the want of a better name. The deposit covers an area



Bird's-Eye View of the Part of the Island of Trinidad Containing the Asphalt Lake. The Tramway on the Lake Connecting with the Ocean pier is shown.

of about 115 acres, and is about a mile in diameter. The tramway upon the surface of the deposit and that which connects it with the large ocean pier is the means by which this unique source of supply is able to furnish its *standard reliable asphalt in unlimited quantity and unvarying quality, promptly to any part of the world.* The three great problems of quality, quantity and accessibility, which means cheap freight, are here successfully solved.

Most paving companies are purchasing *Trinidad Lake Asphalt* as the best material for cementing together the other ingredients (sand, limestone powder, etc.) of their pavements. As architects do well to require and builders use the best Portland cement in their buildings, so cities safely specify and asphalt paving companies gladly employ Trinidad Lake Asphalt in their pavements. Like cement in masonry, asphaltum in pavements is but a small per cent. of the materials used. The best is the cheapest and gives satisfactory results to all concerned.